

(12) **United States Patent**  
**Kline**

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(45) **Date of Patent:** **Aug. 18, 2015**

(54) **SEGMENTED ADAPTABLE MOBILITY AID  
DEVICE FOR LEVEL AND INCLINED  
WALKWAYS AND FOR STAIRS**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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**U.S. Cl.**

CPC **A47C 7/008** (2013.01); **A61H 3/00** (2013.01);  
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(2013.01)

**Field of Classification Search**

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USPC ..... 135/66, 67  
See application file for complete search history.

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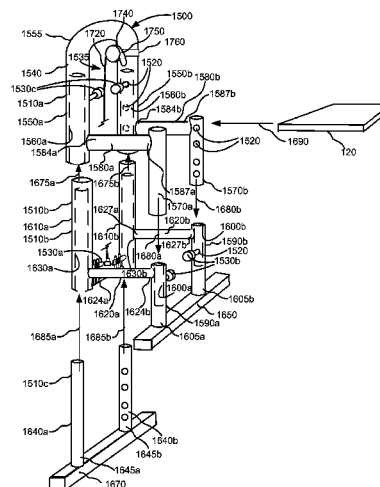
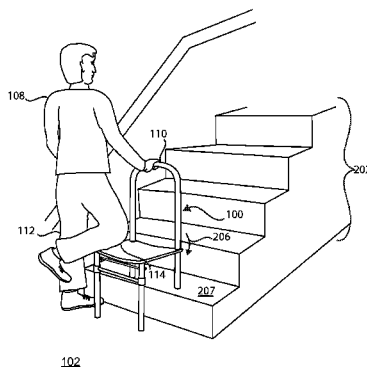
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**(57)**

**ABSTRACT**

A segmented adaptable mobility aid device is disclosed that has length-adjustable front and rear legs, a handle, and a knee support platform coupled to the legs and the handle, the legs being adjustable within a range of lengths suitable to straddle steps for ascending and descending stairways, as well as to function on the level, or on a ramp. The lengths of the legs can be adjusted in tandem via single-hand operability of an adjustment mechanism. The knee support platform provides support for an impaired lower leg of a user, not requiring the leg to contact the stairs, and also not requiring the leg to be held mid-air in a hopping motion. The handle enables one-handed use of the segmented adaptable mobility aid device. In some embodiments, spring loaded pins or a pull bar to activate the pins, enable the single-hand operability of the adjustment mechanism.

**17 Claims, 35 Drawing Sheets**



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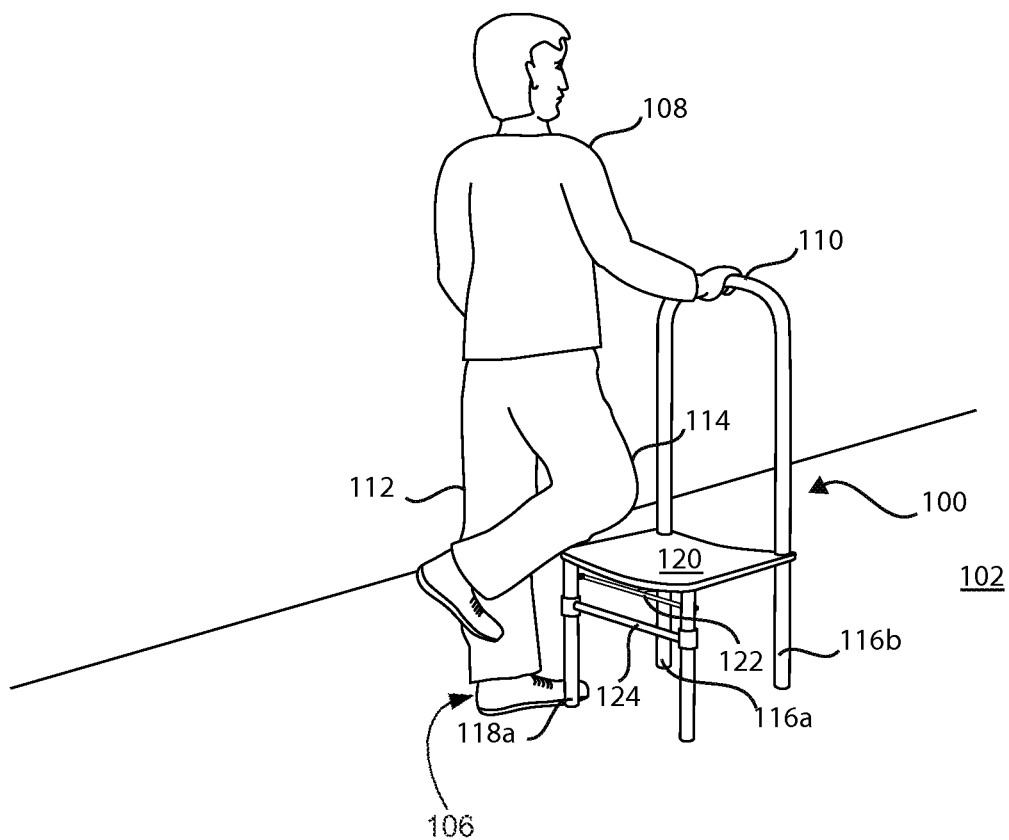


FIG. 1A

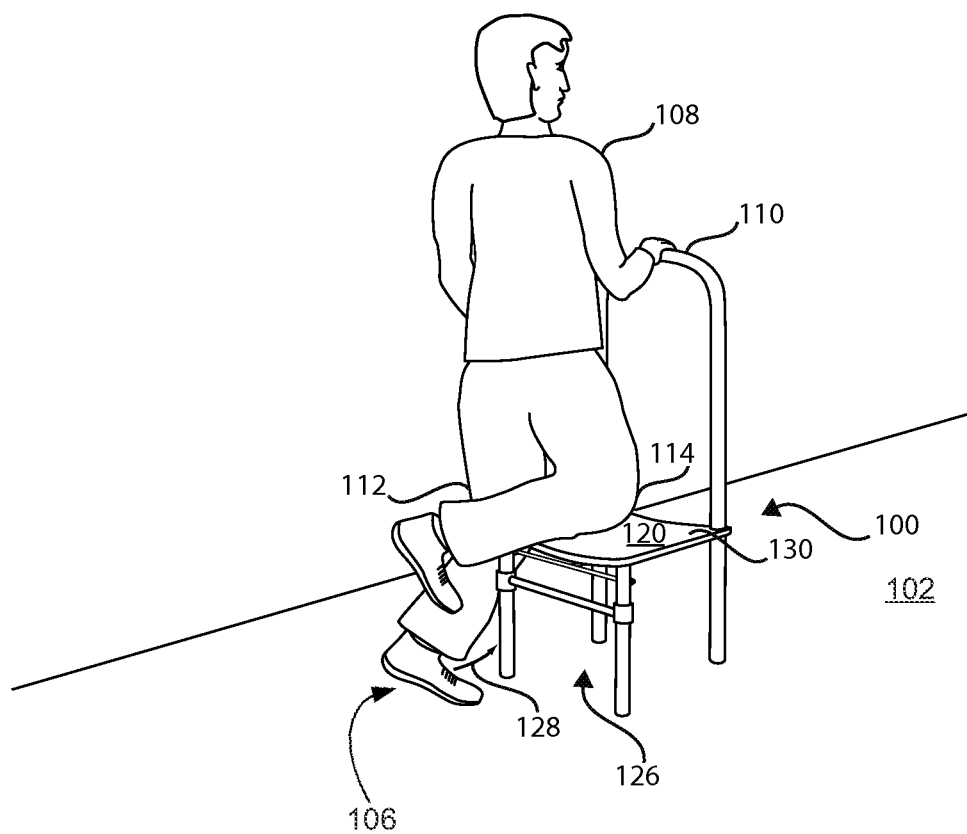


FIG. 1B

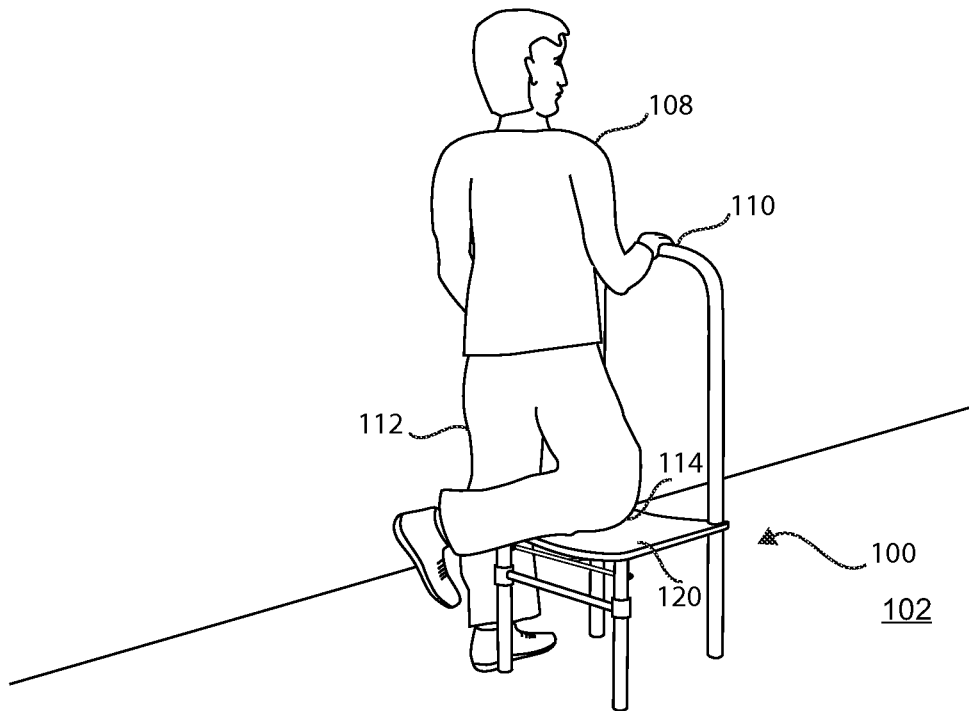


FIG. 1C

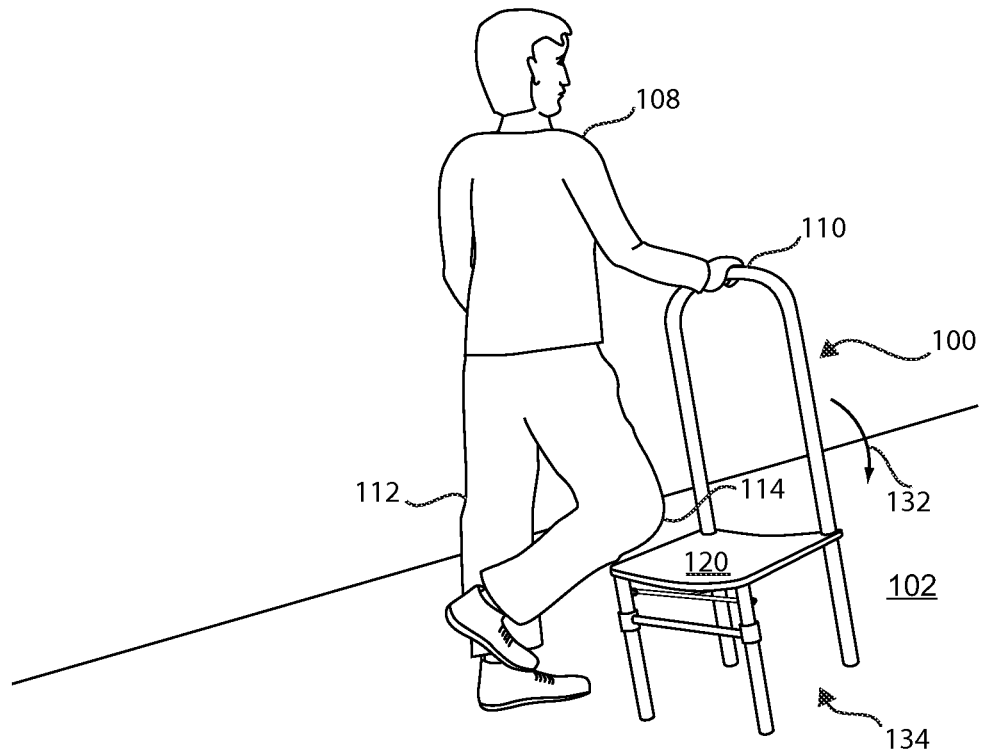


FIG. 1D

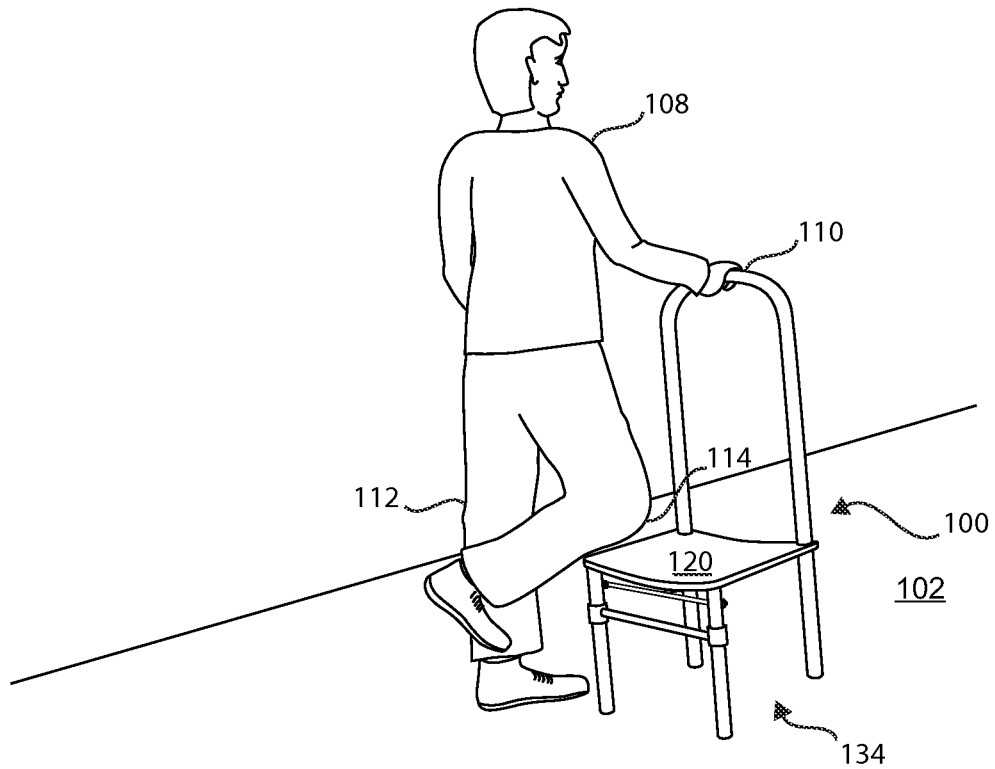


FIG. 1E

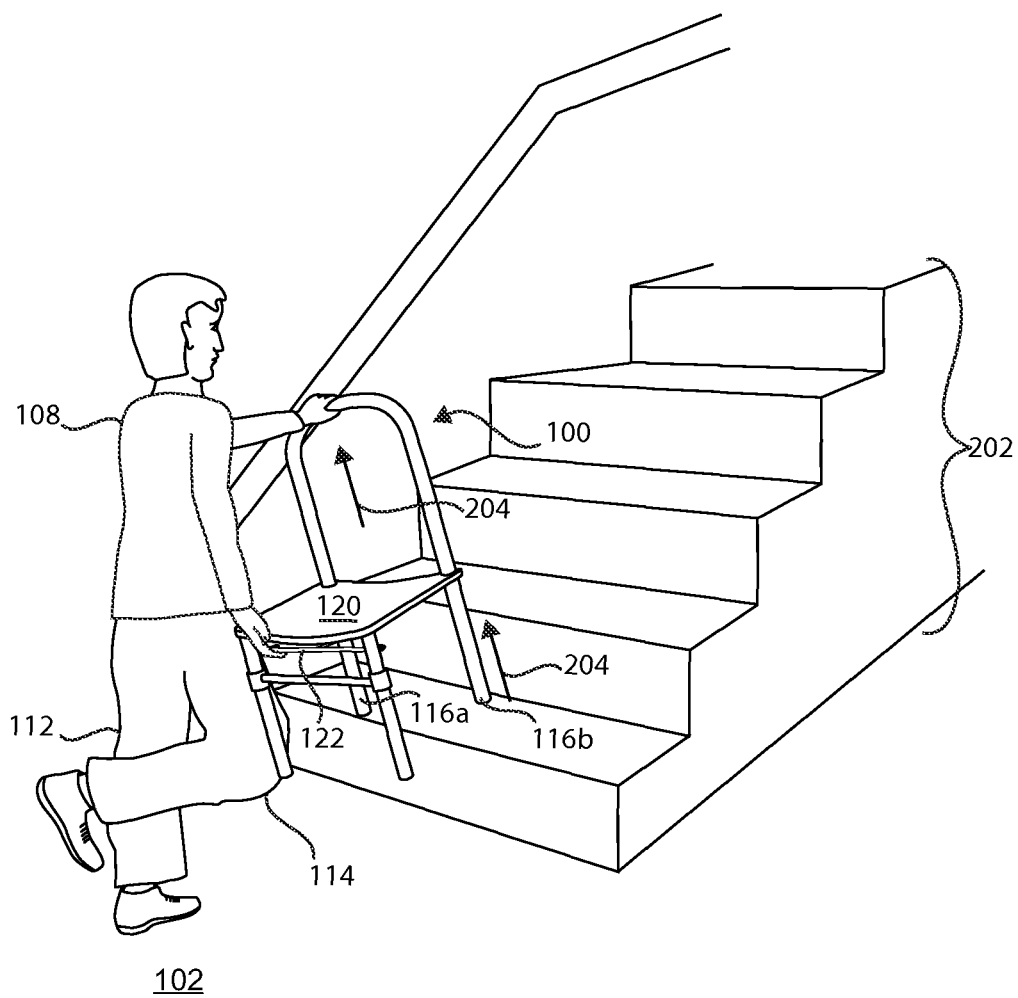
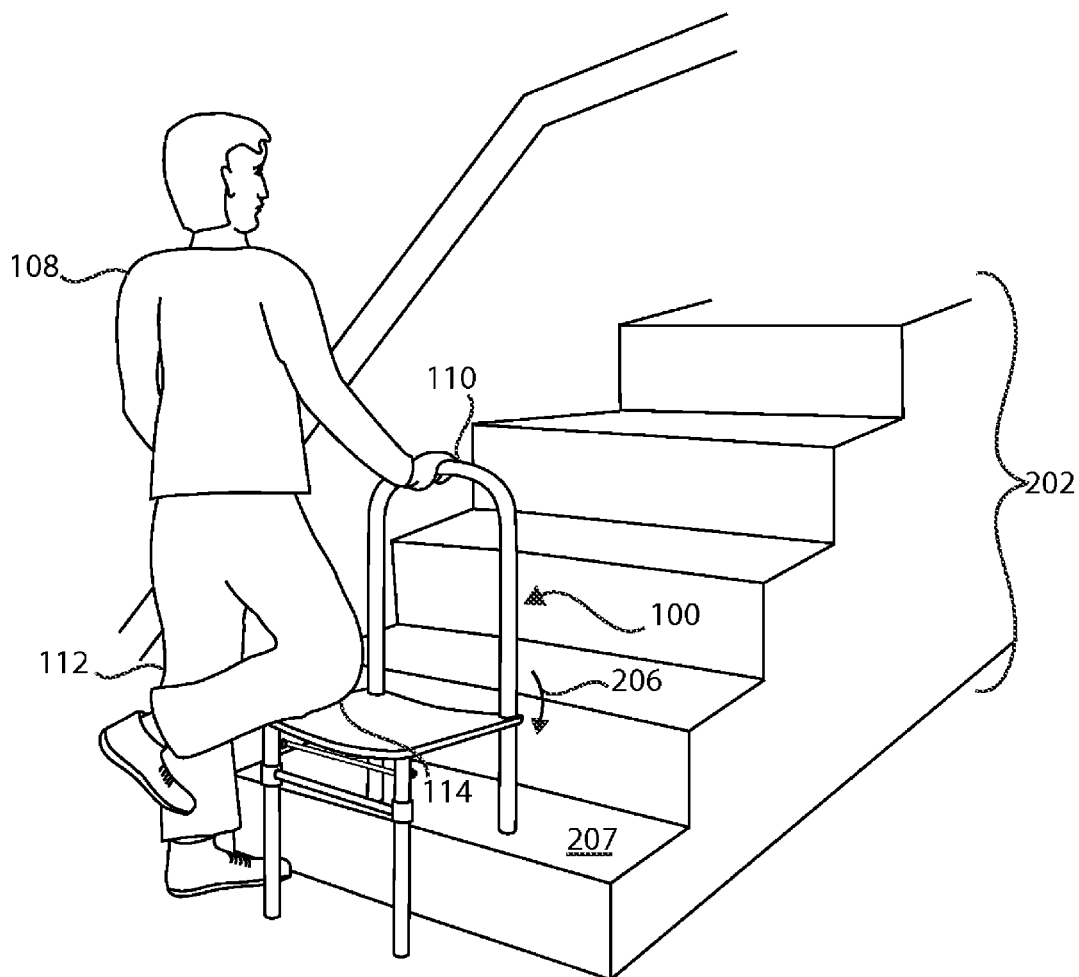


FIG. 2A





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FIG. 2B

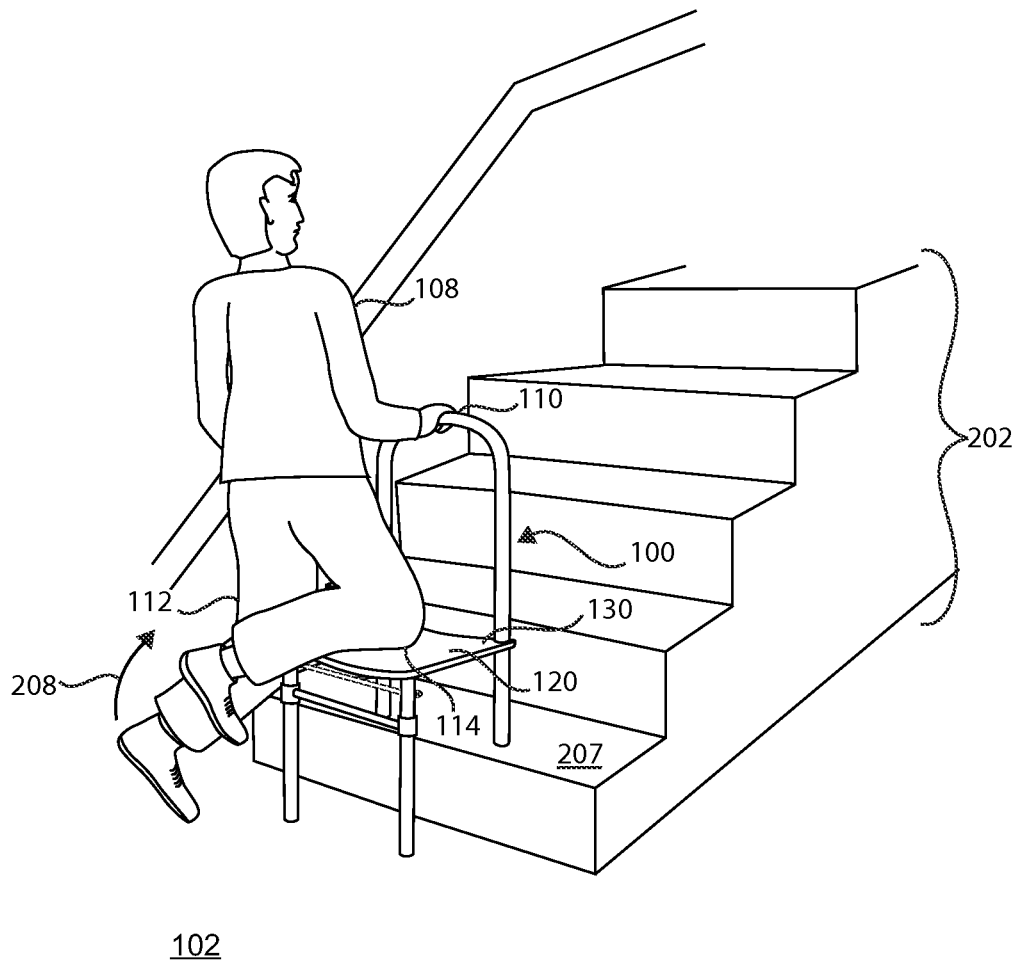


FIG. 2C

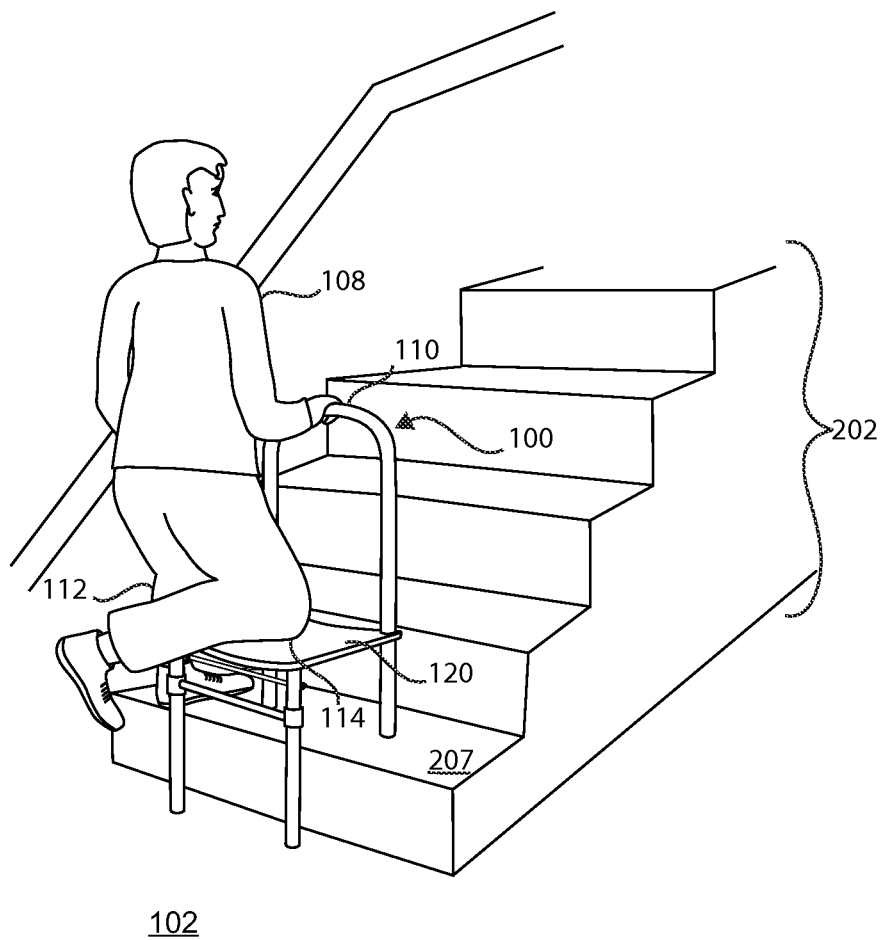


FIG. 2D

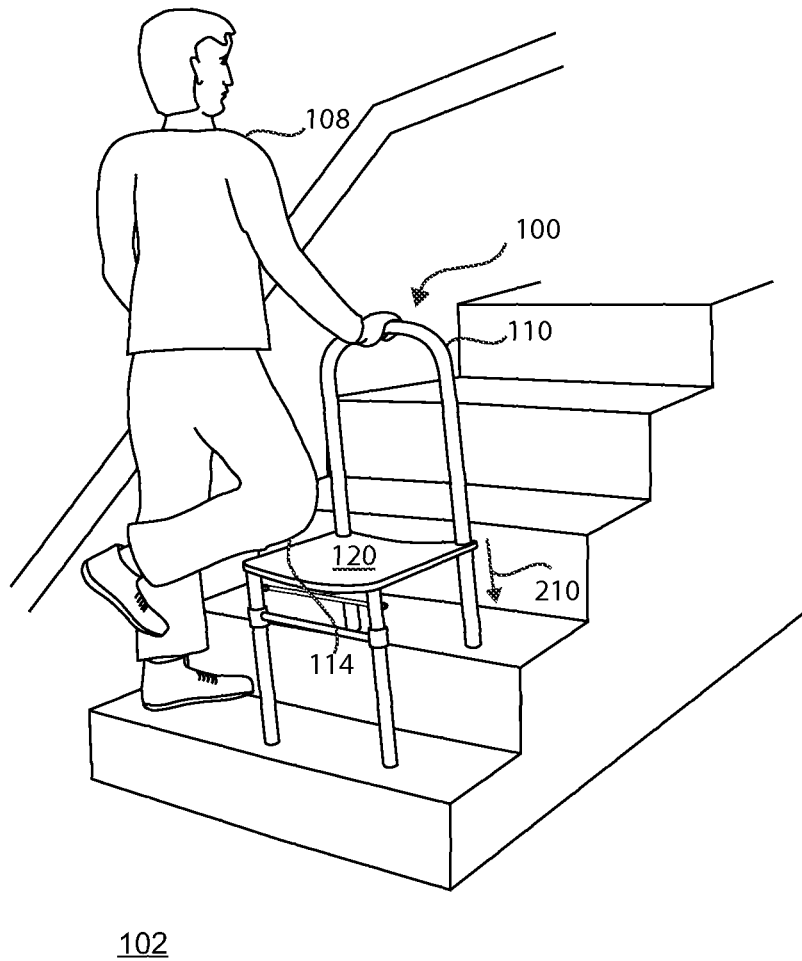
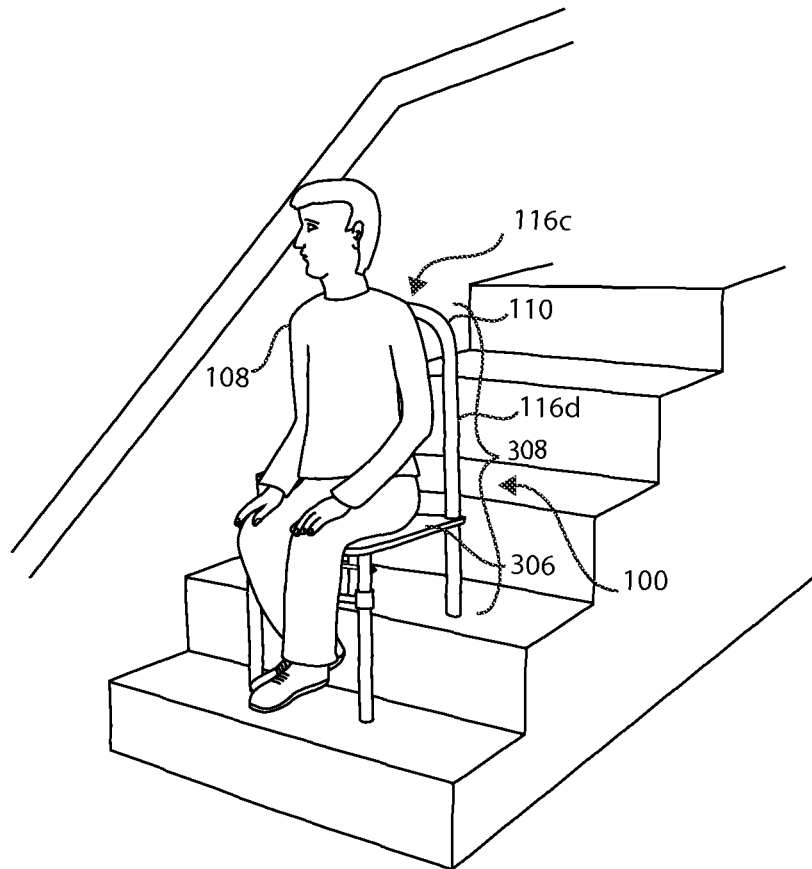
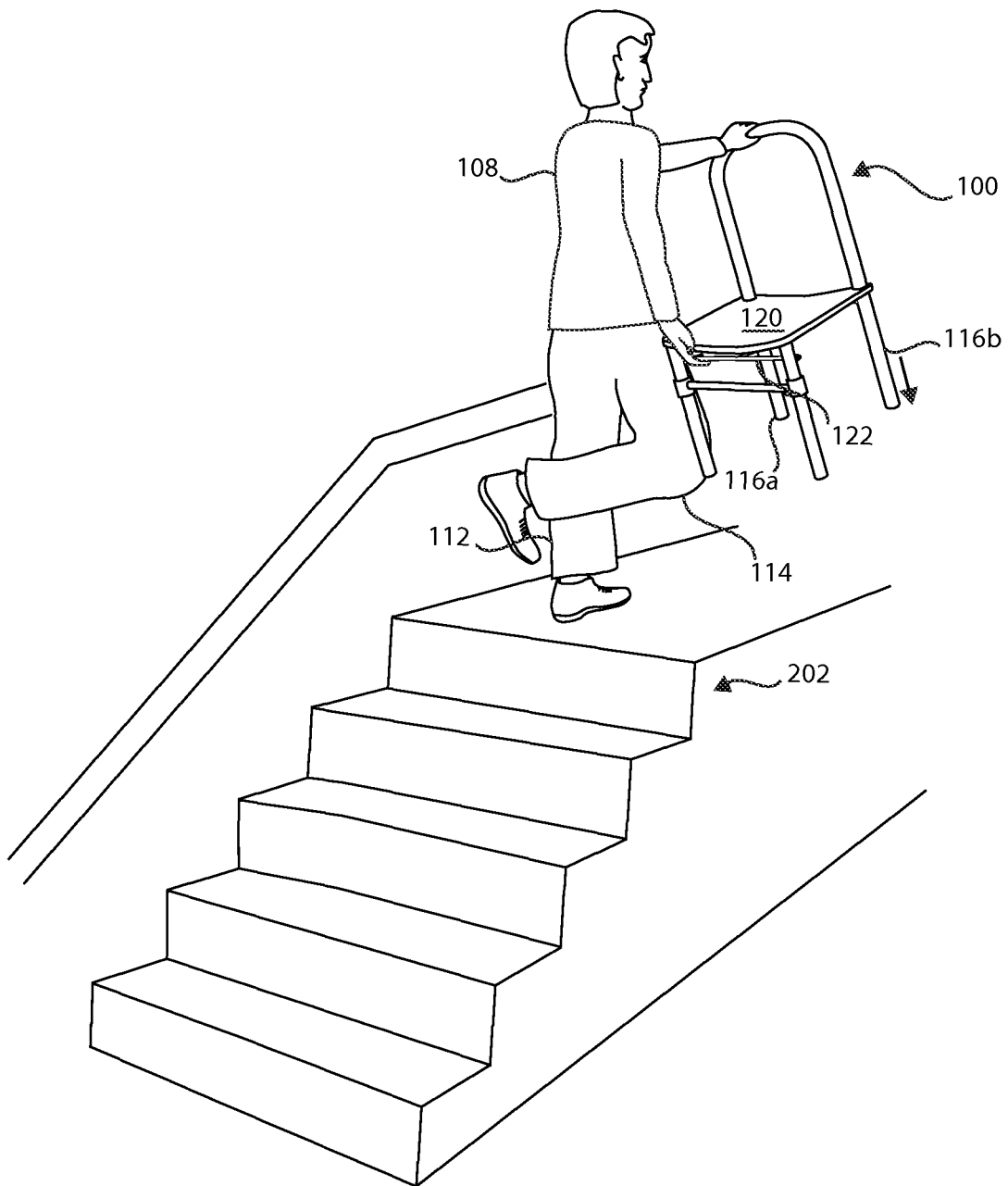


FIG. 2E



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FIG. 3



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FIG. 3A

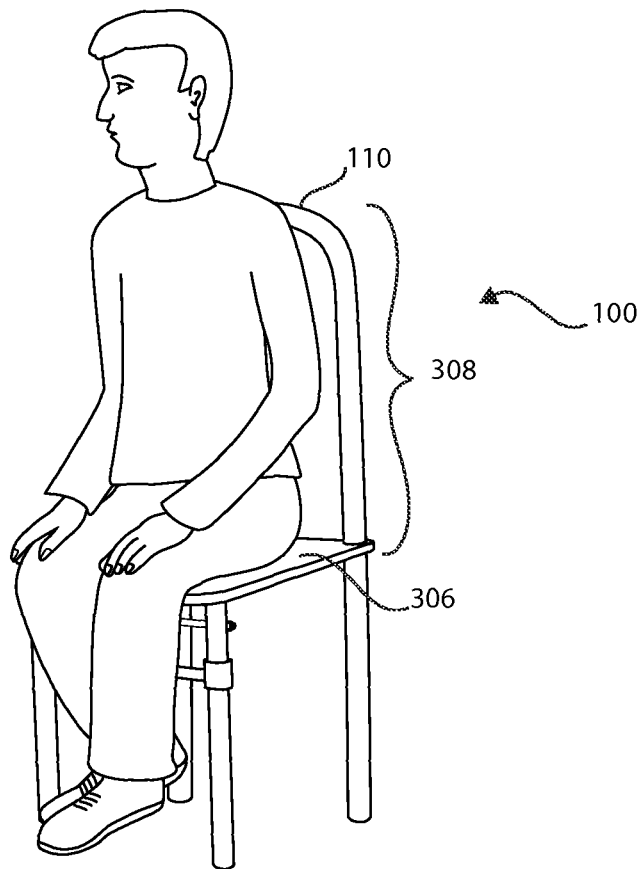


FIG. 3B

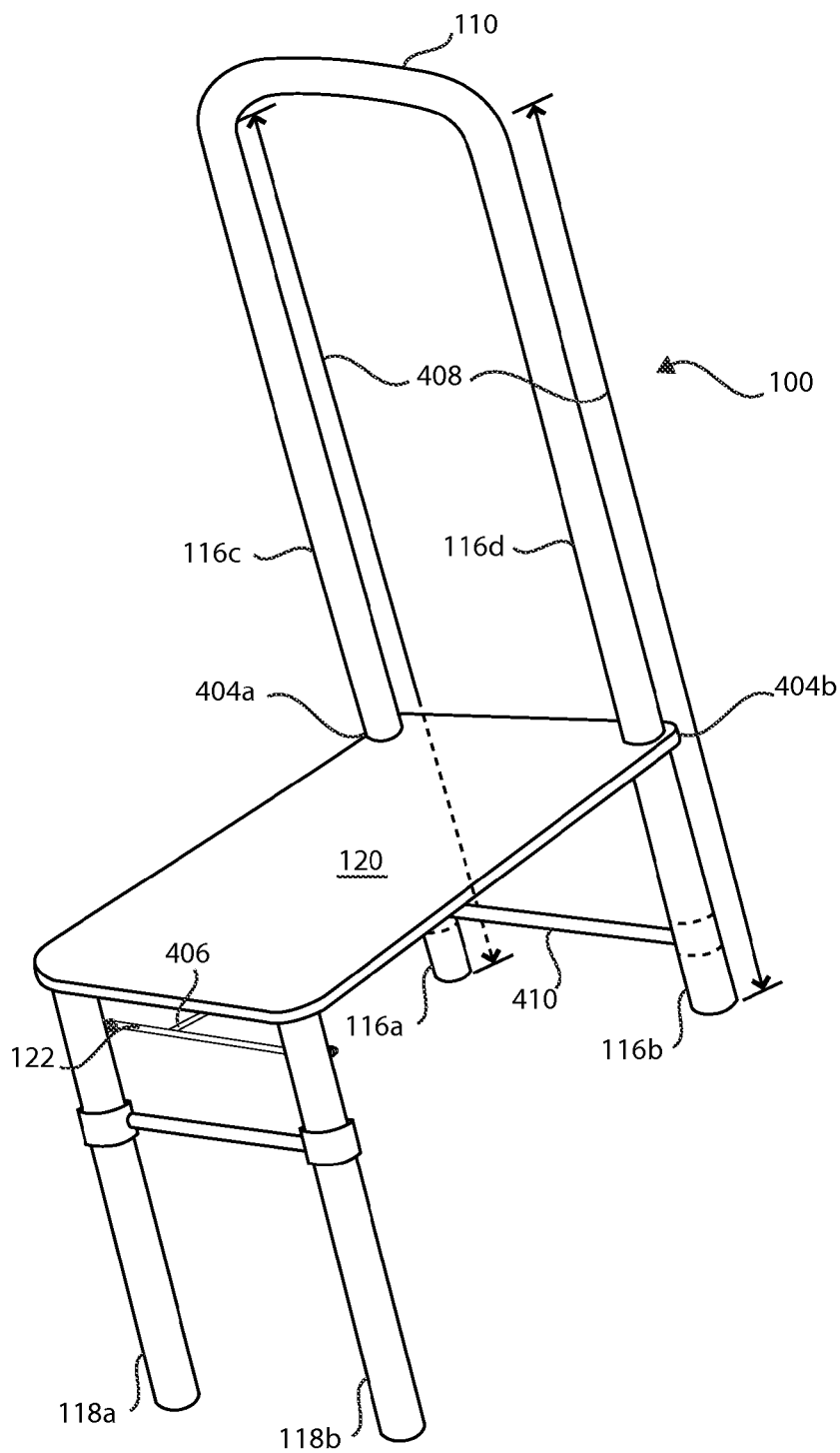


FIG. 4



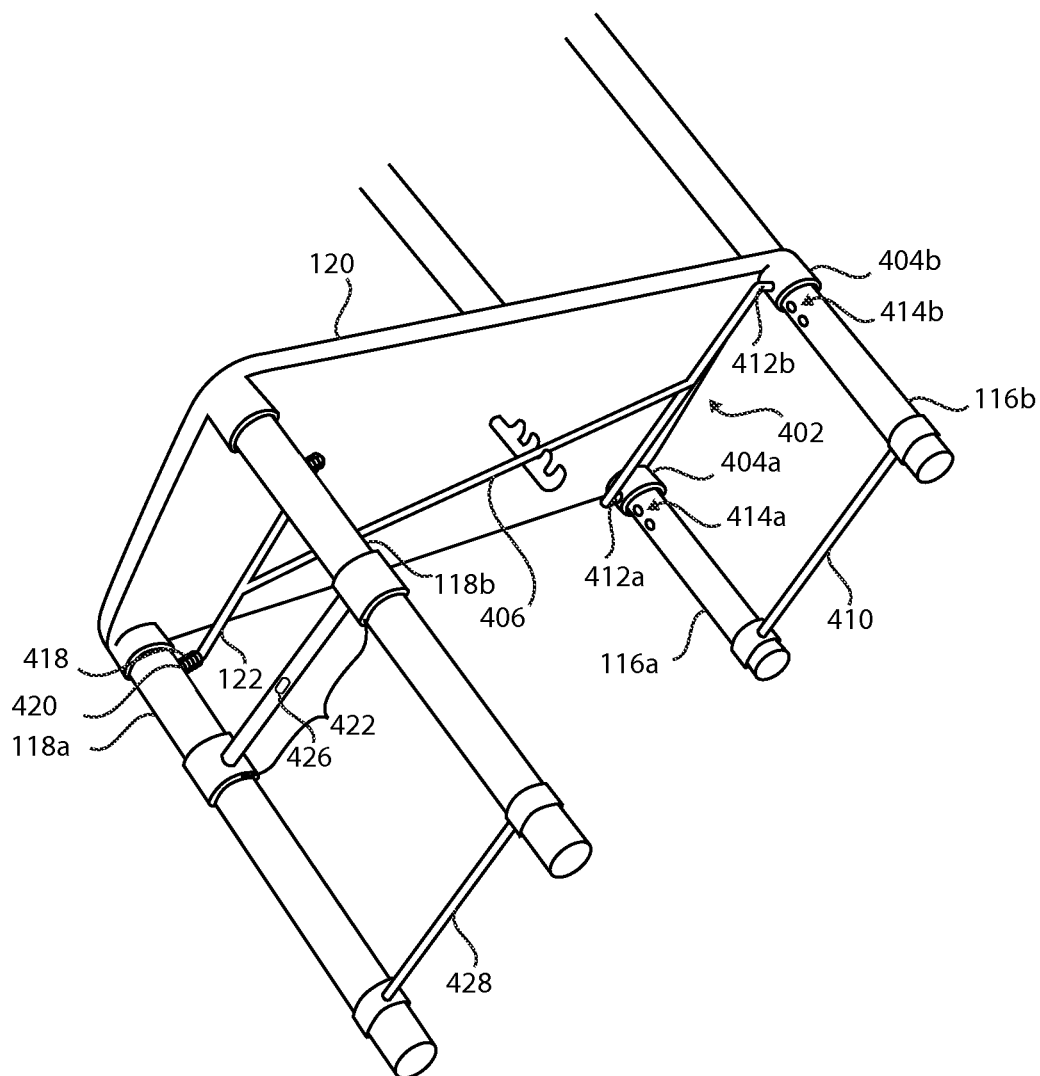


FIG. 4A

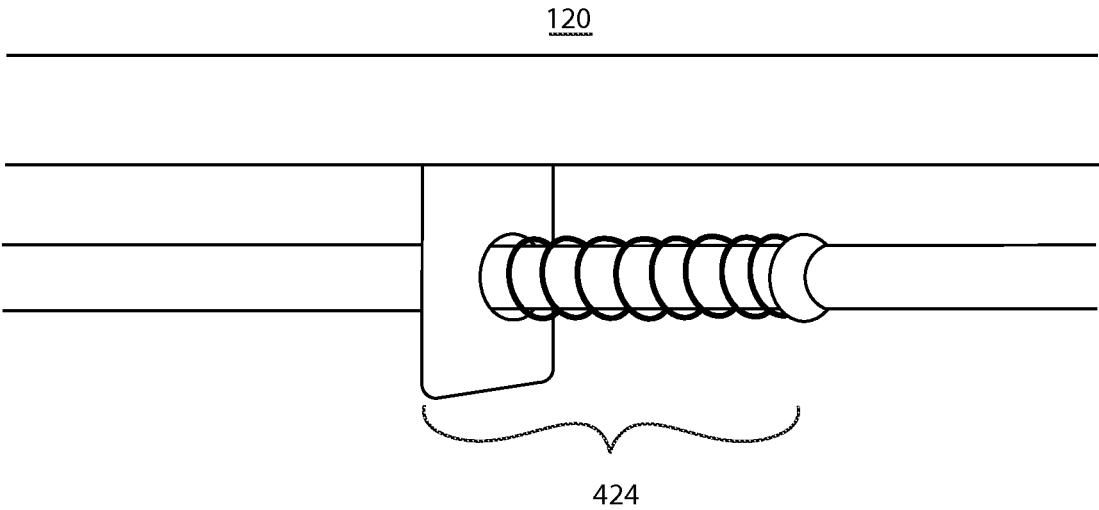


FIG. 4B

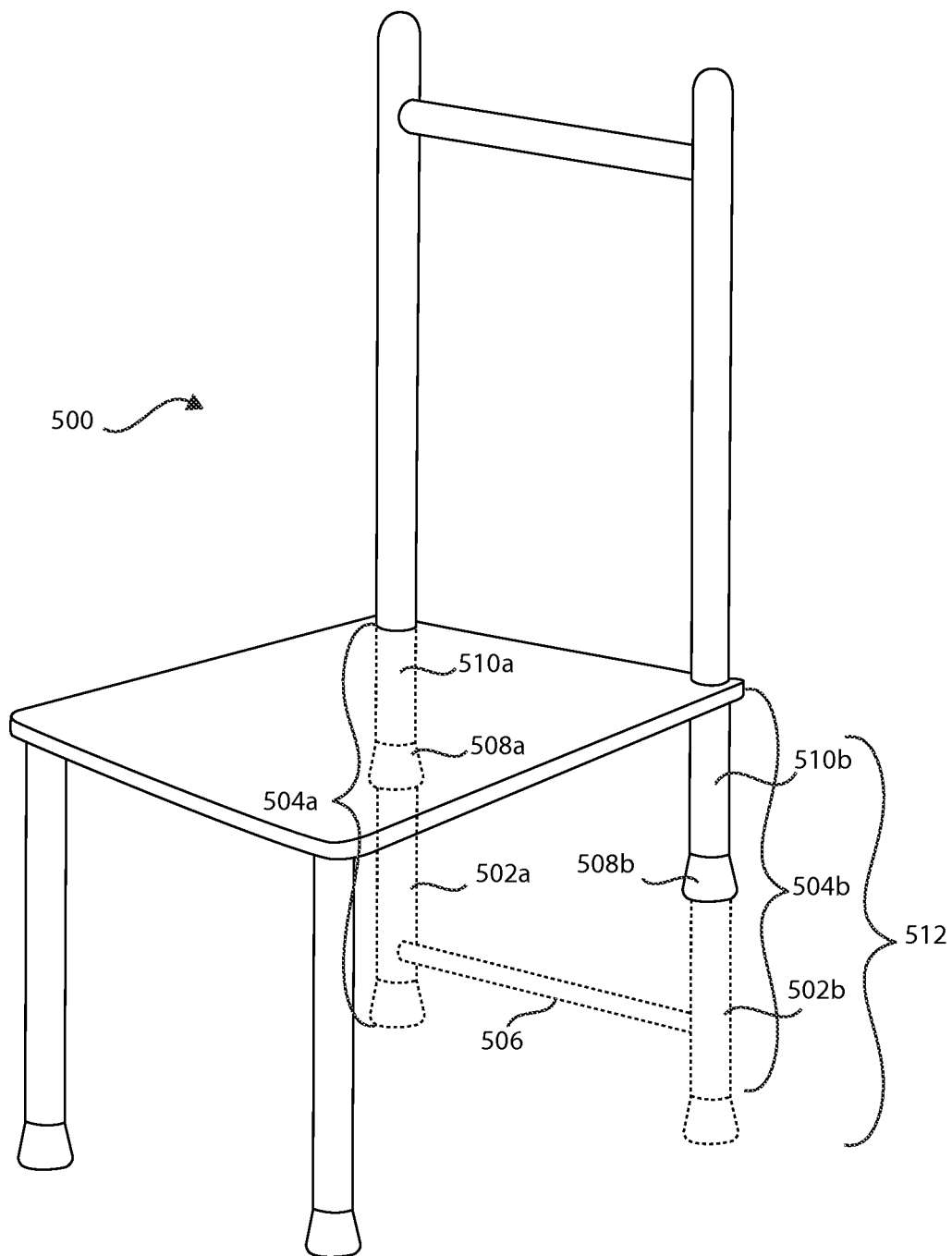


FIG. 5

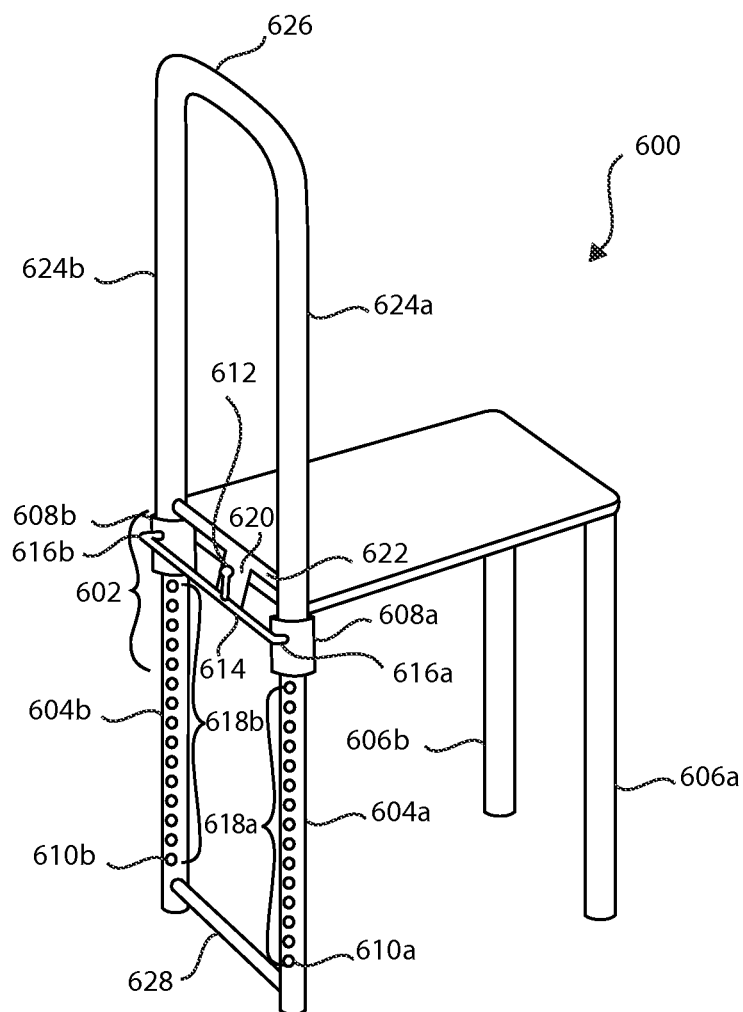


FIG. 6

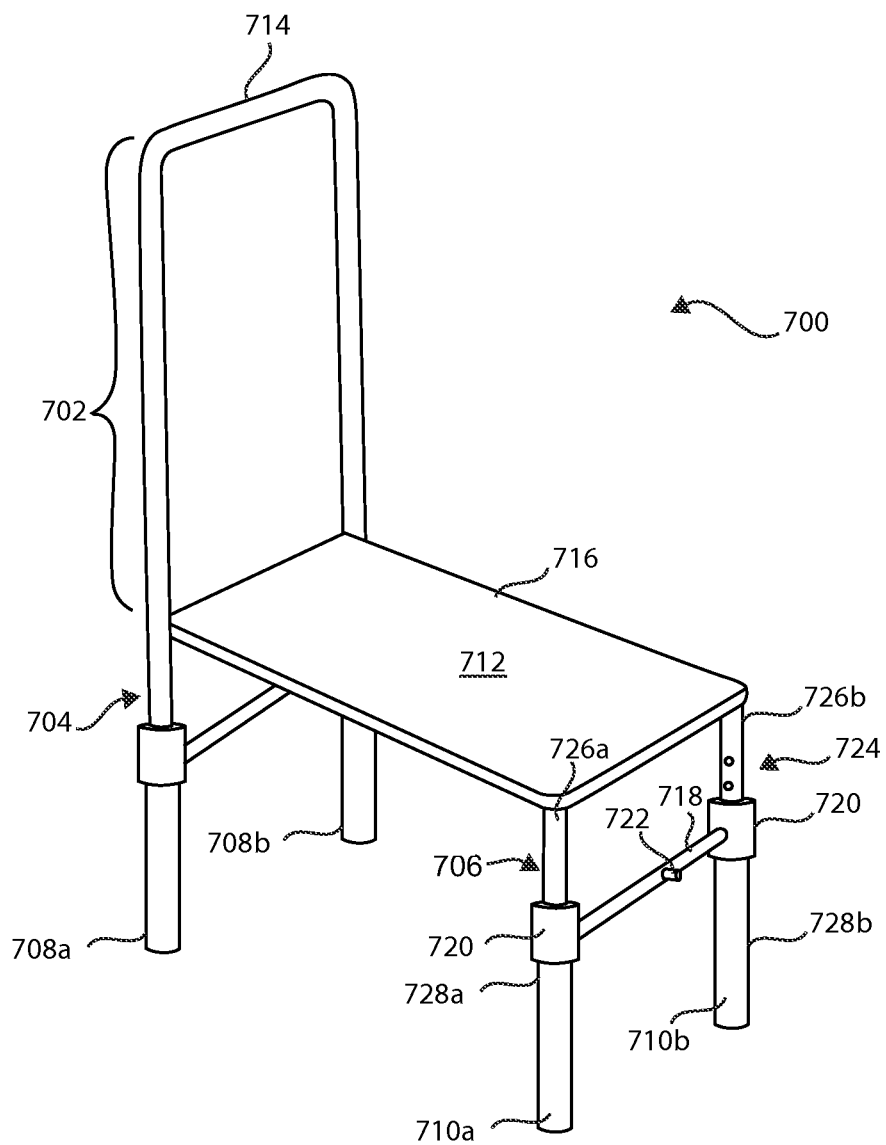


FIG. 7

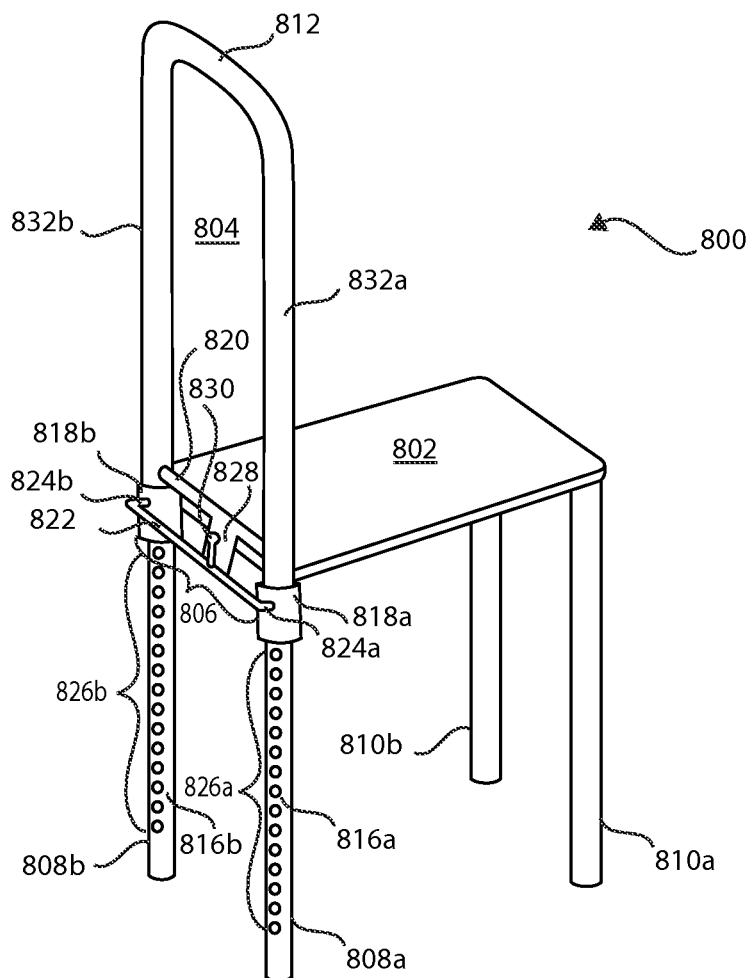


FIG. 8

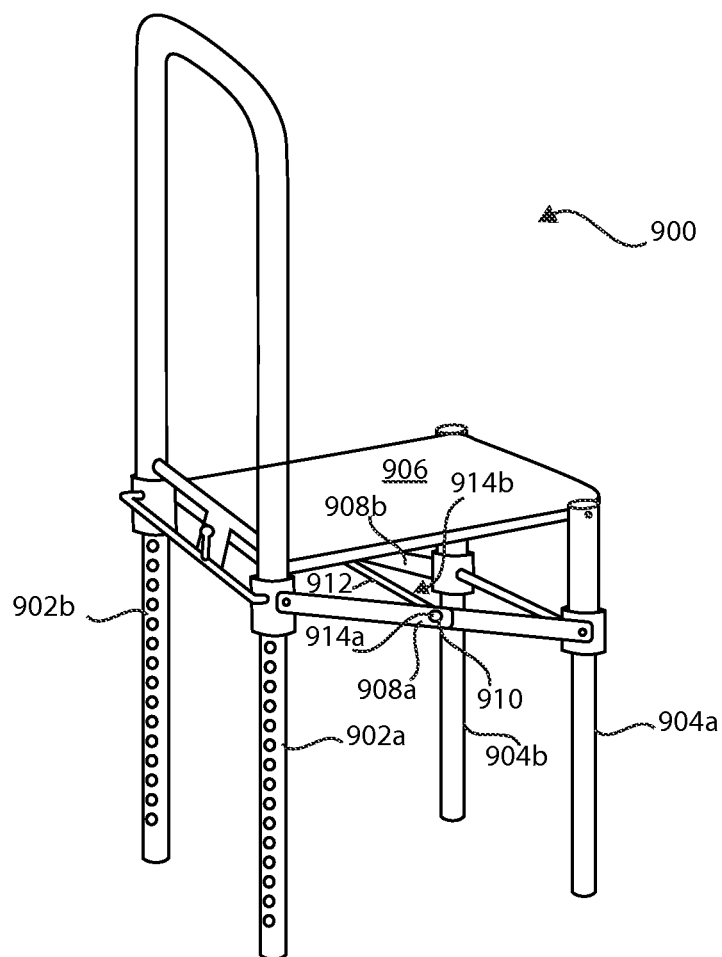


FIG. 9

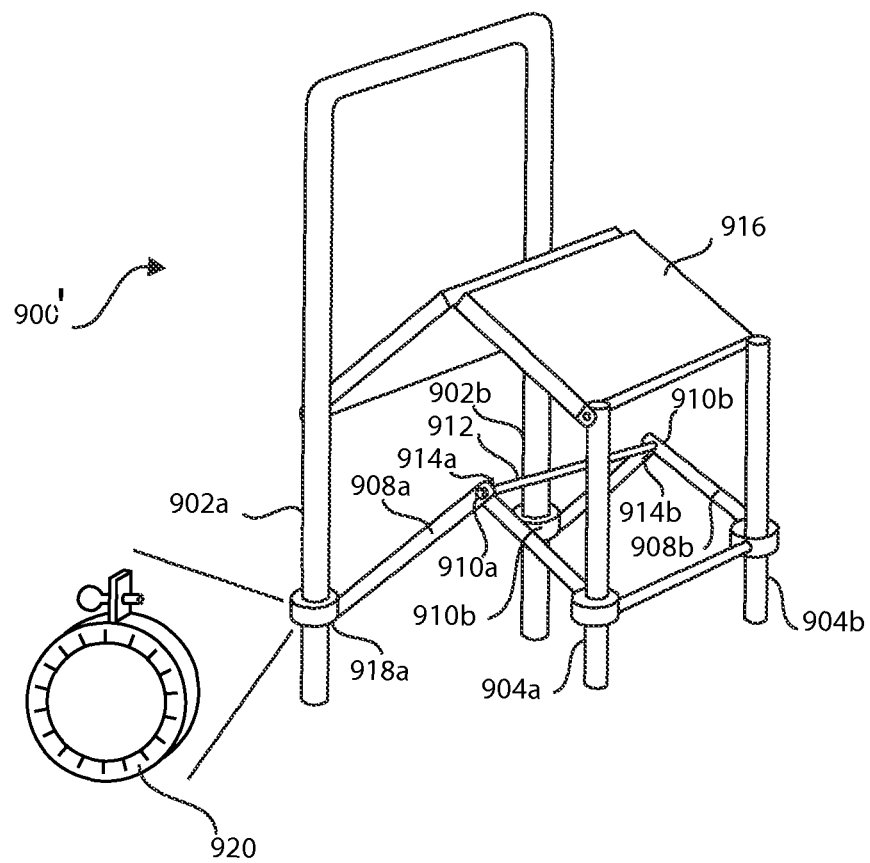


FIG. 9A



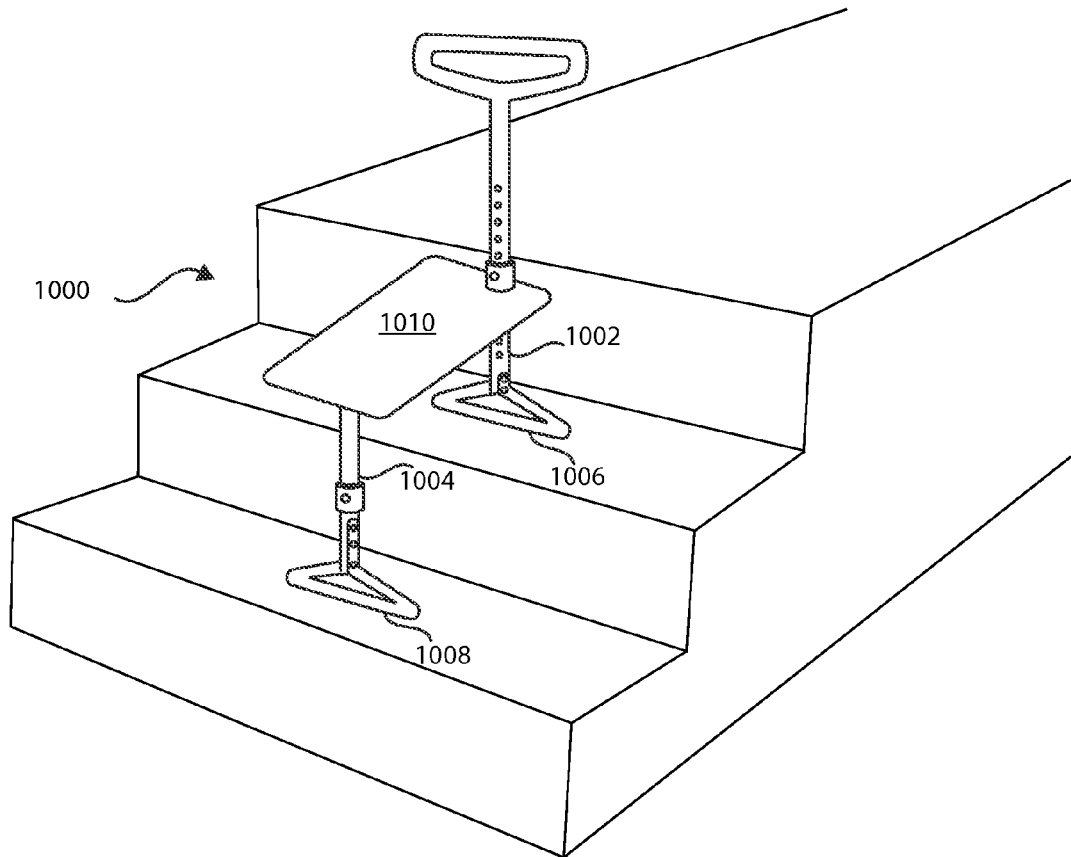


FIG. 10

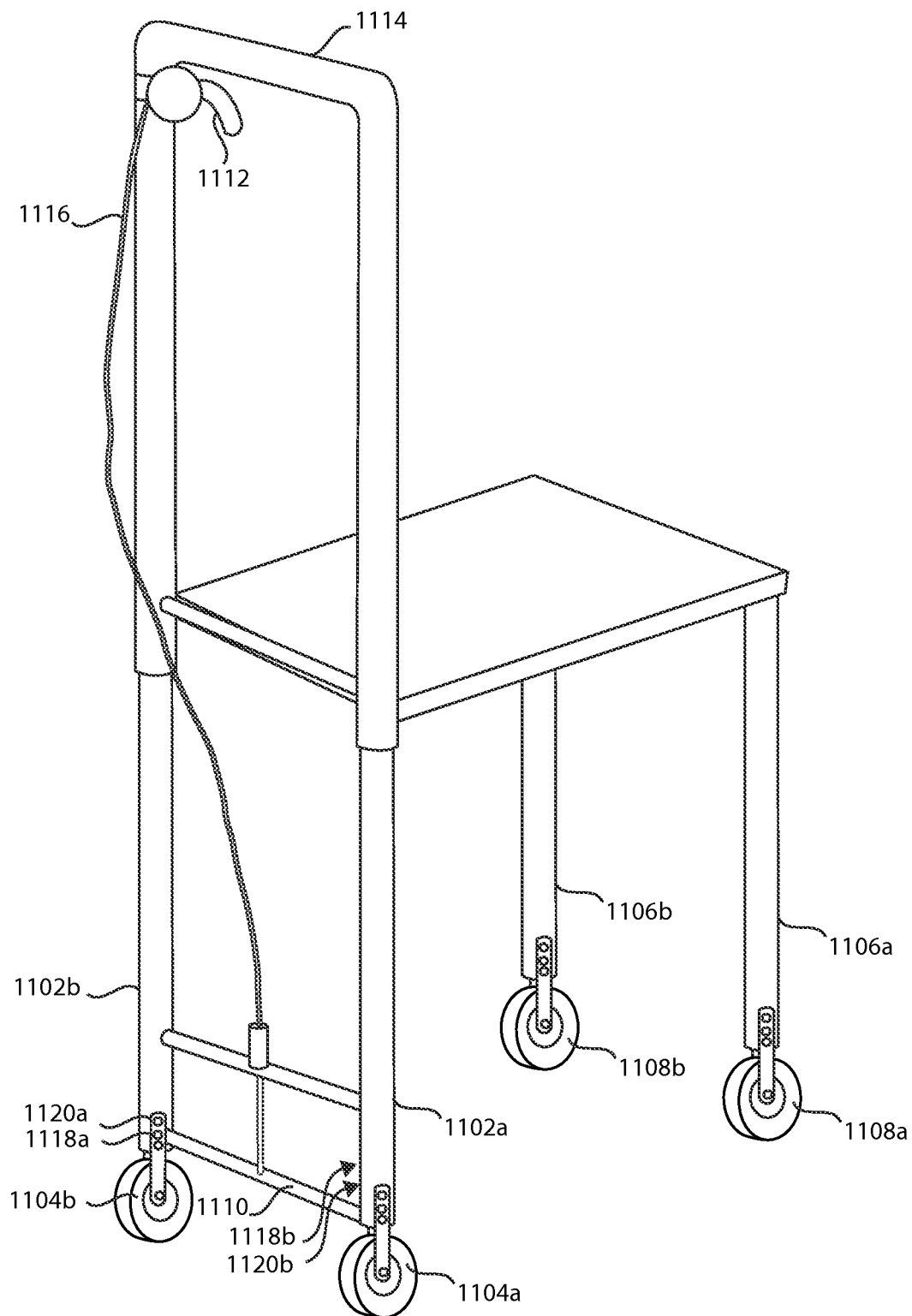


FIG. 11

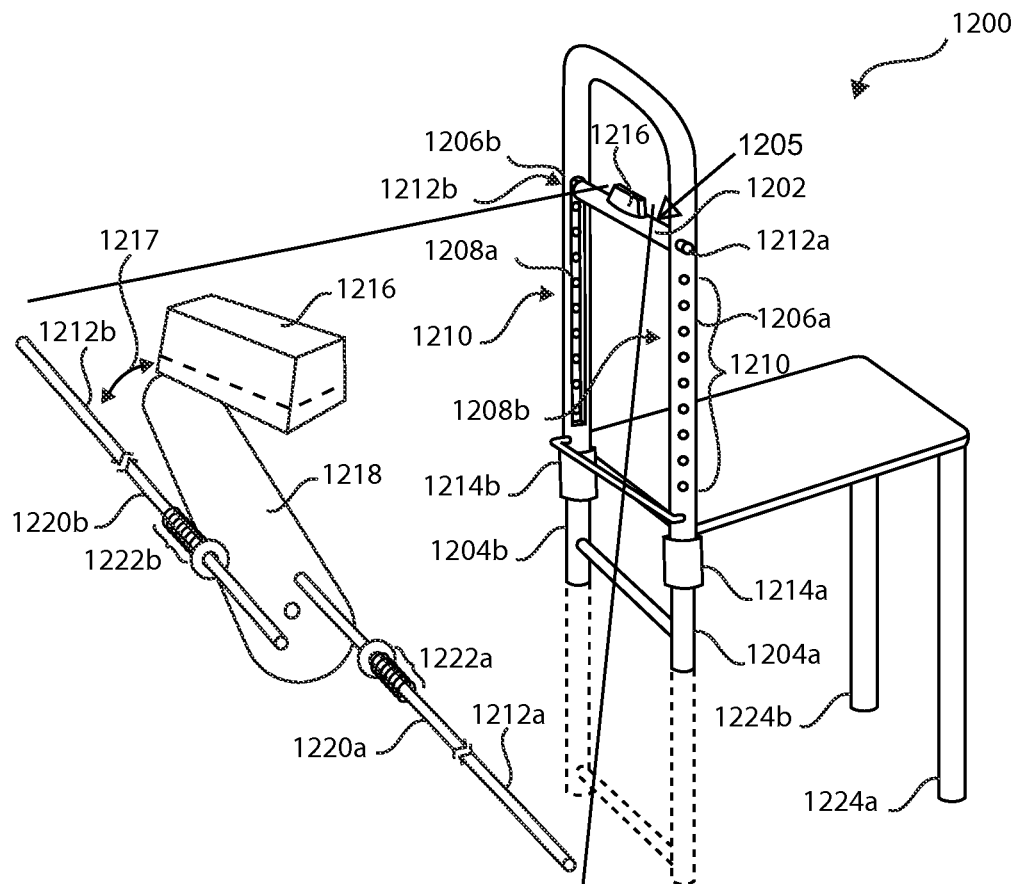


FIG. 12A

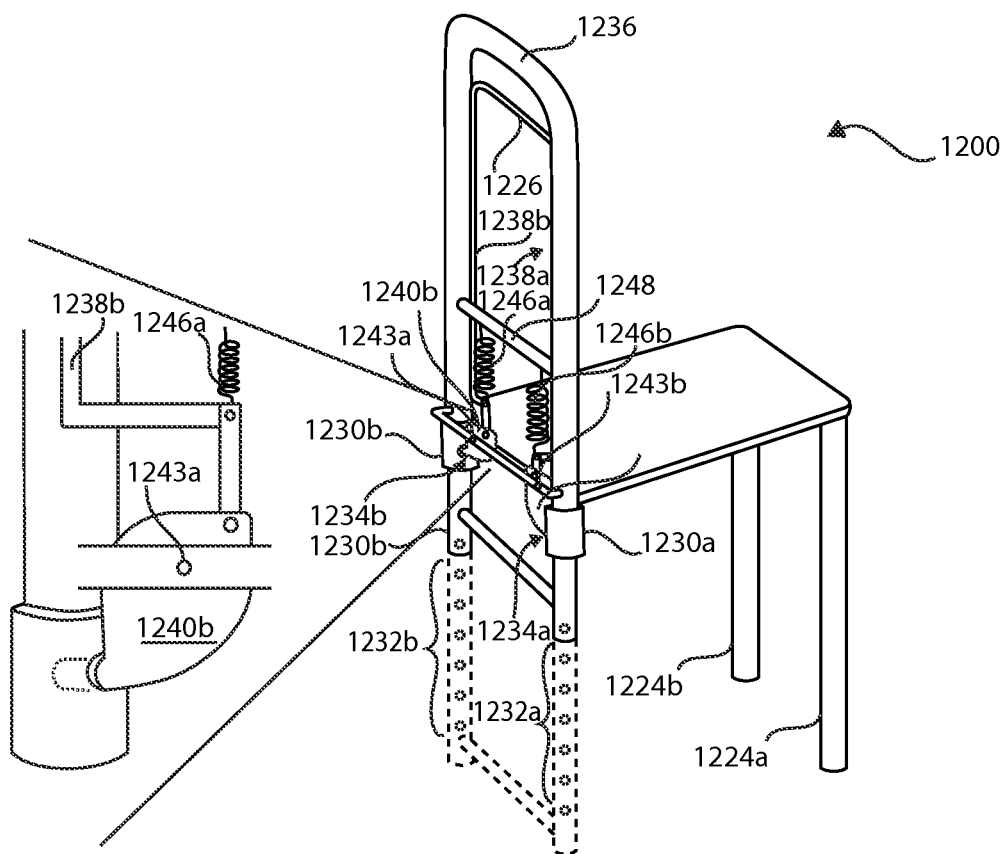


FIG. 12B

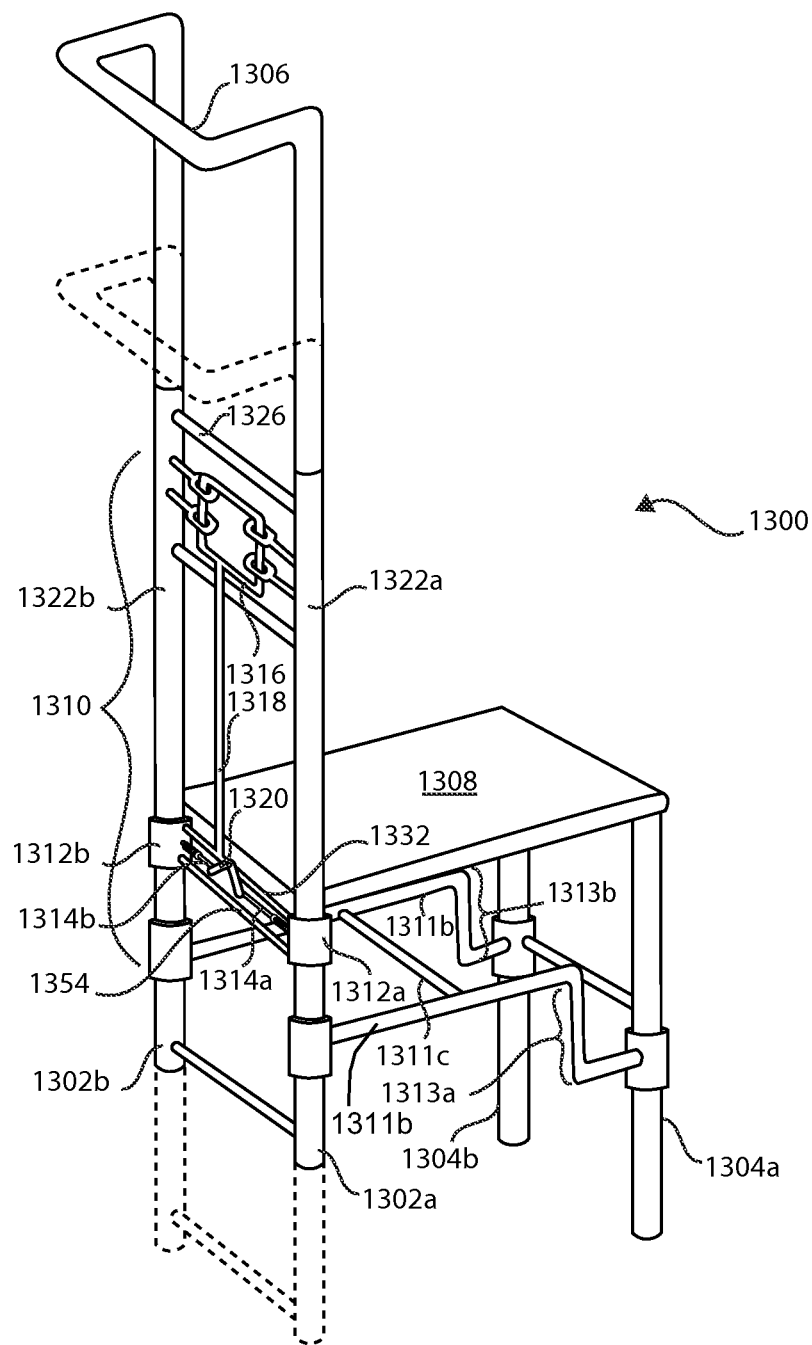


FIG. 13

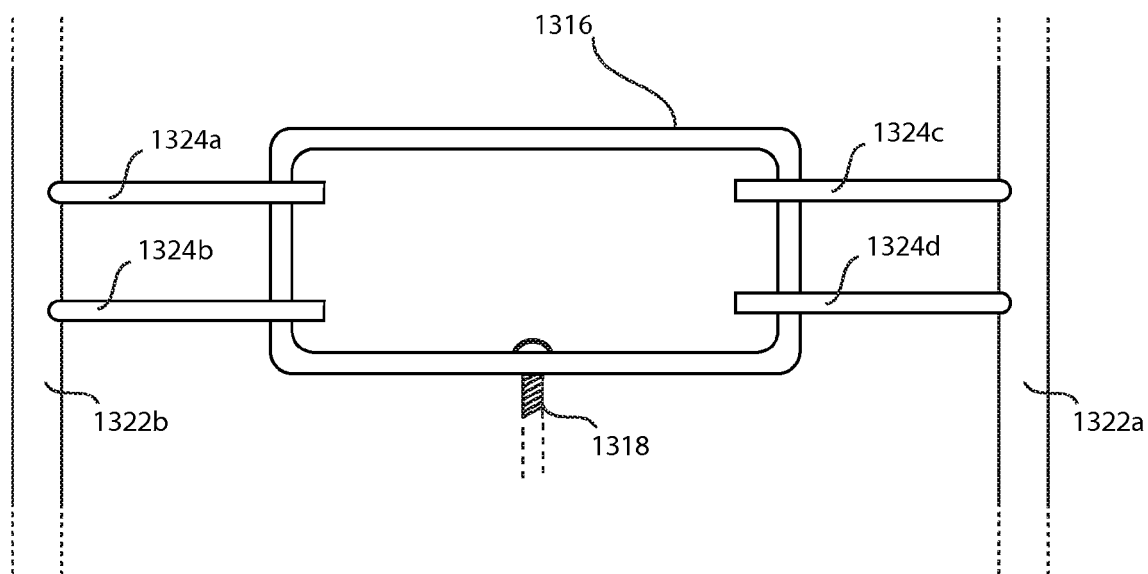


FIG. 13A

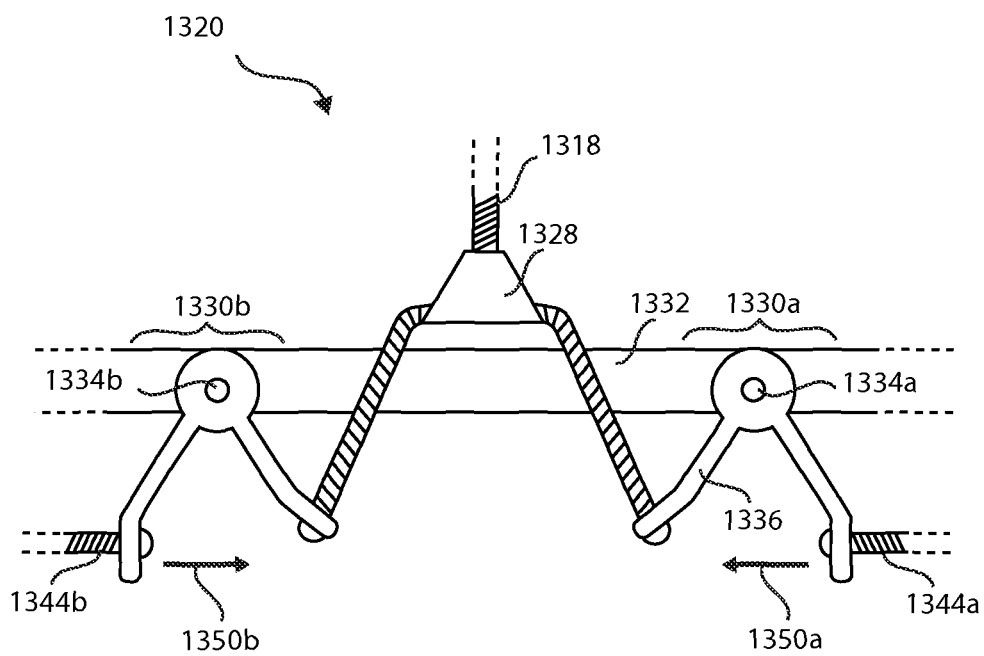


FIG. 13B

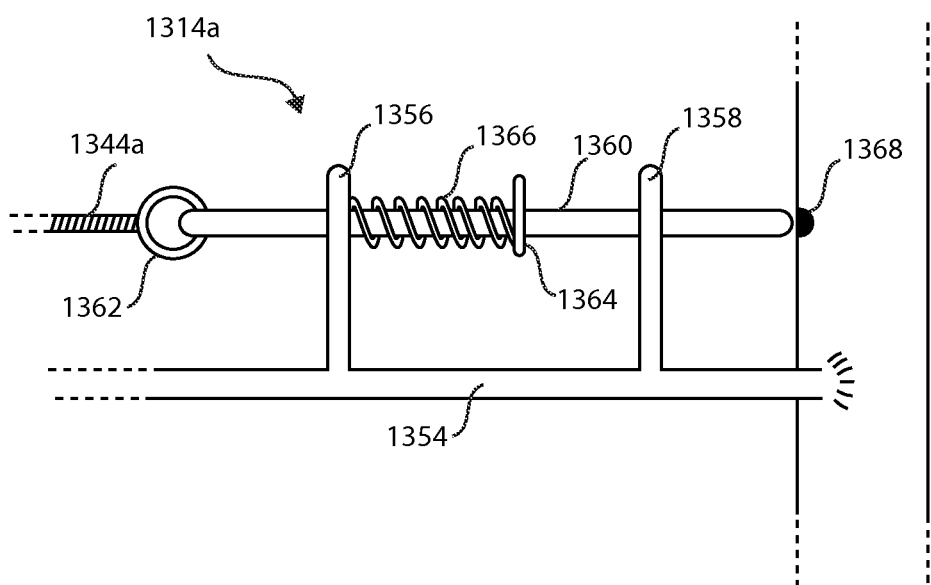


FIG. 13C



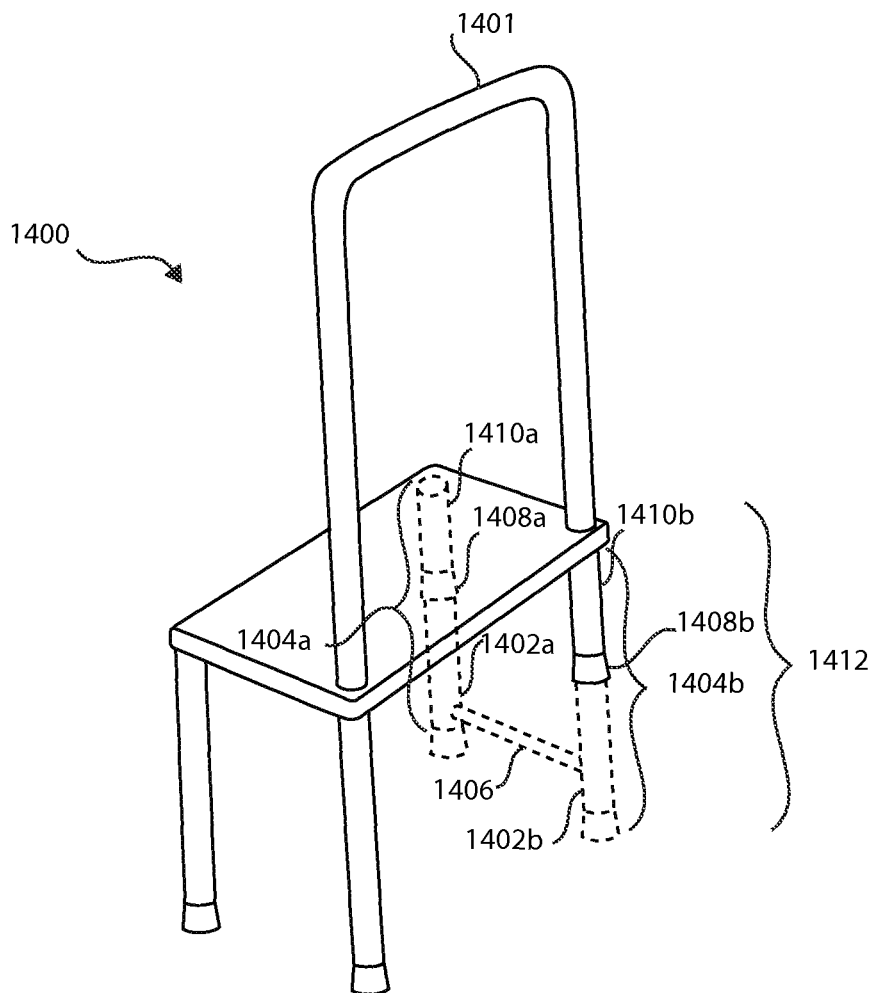


FIG. 14

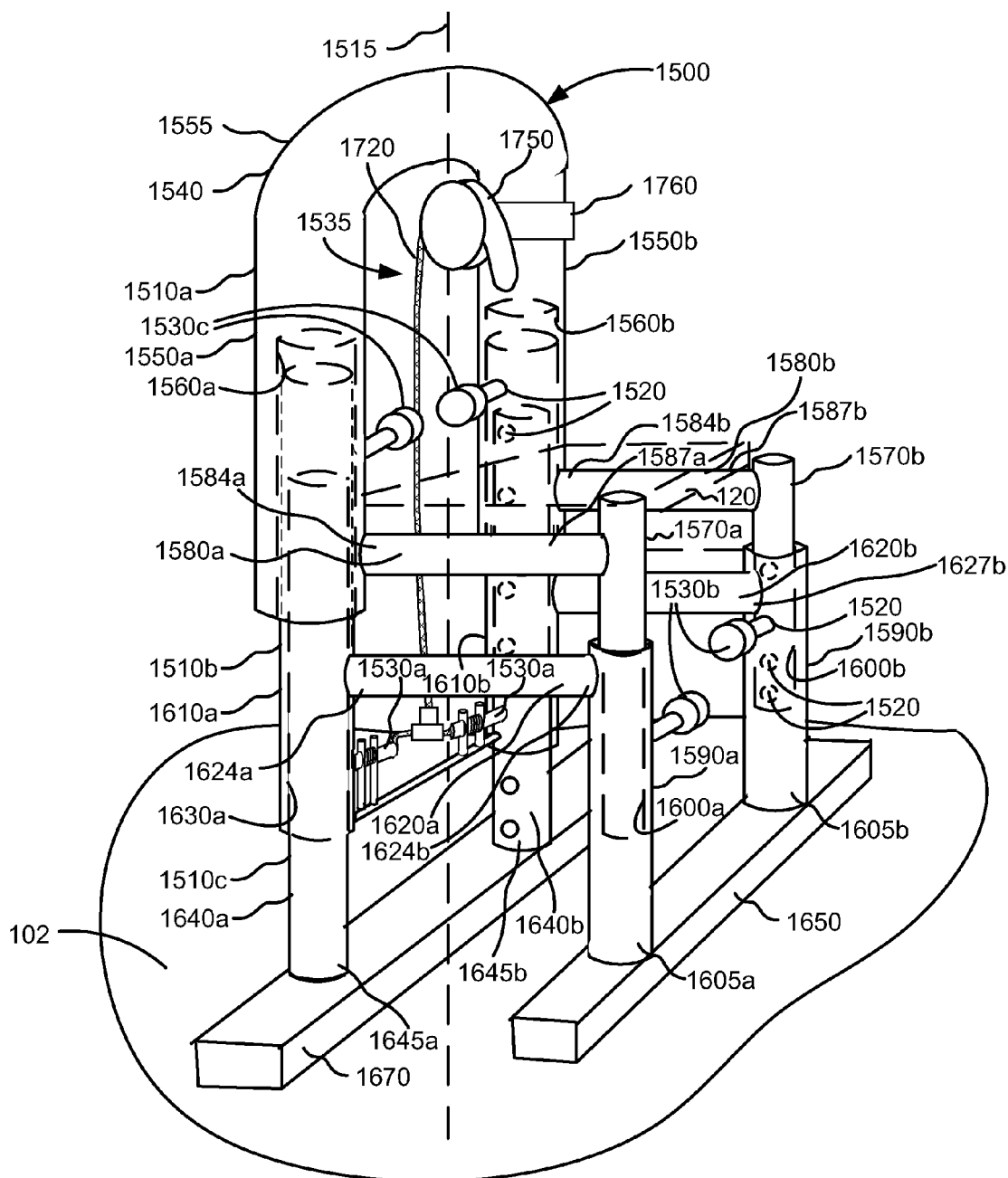


FIG. 15

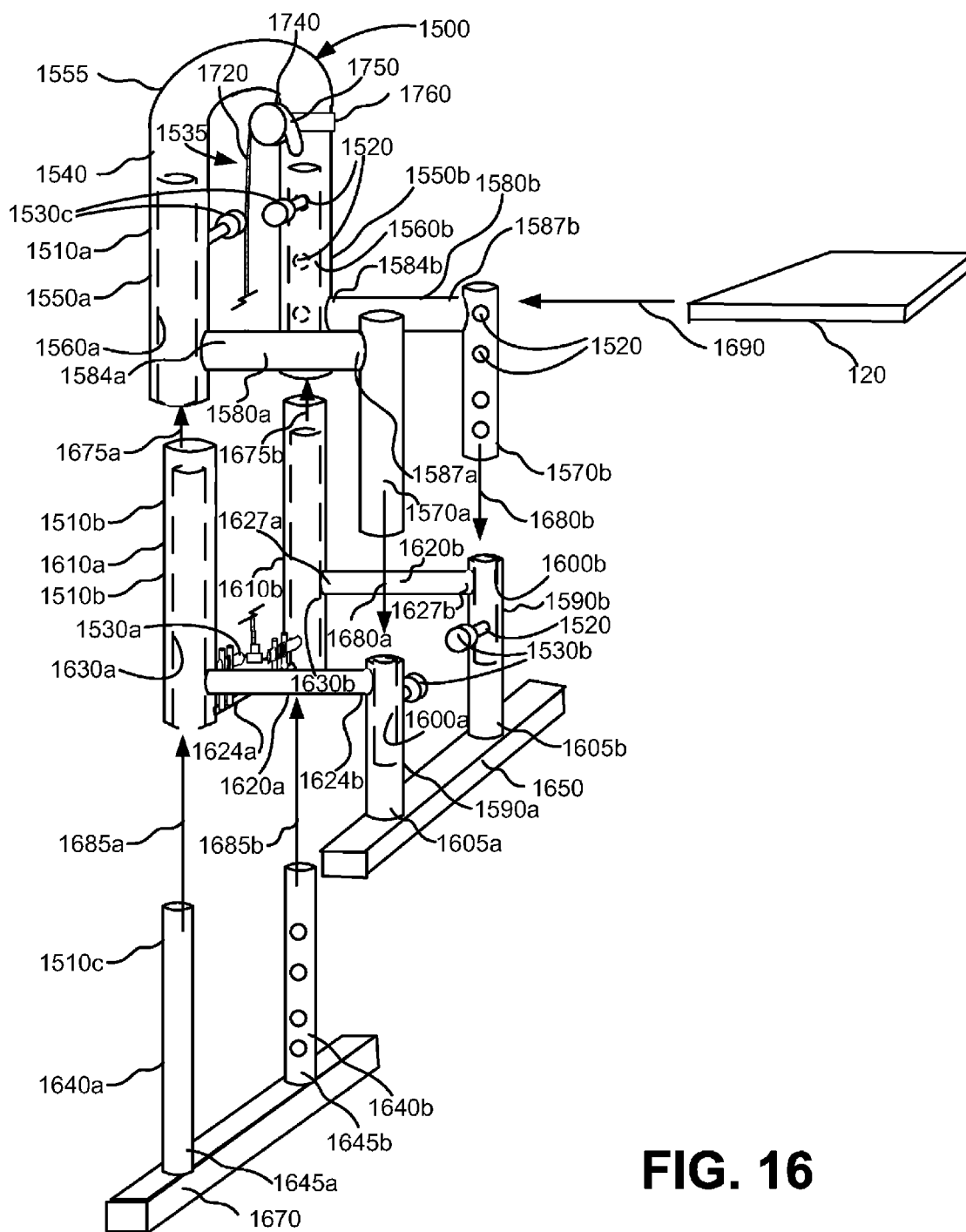


FIG. 16

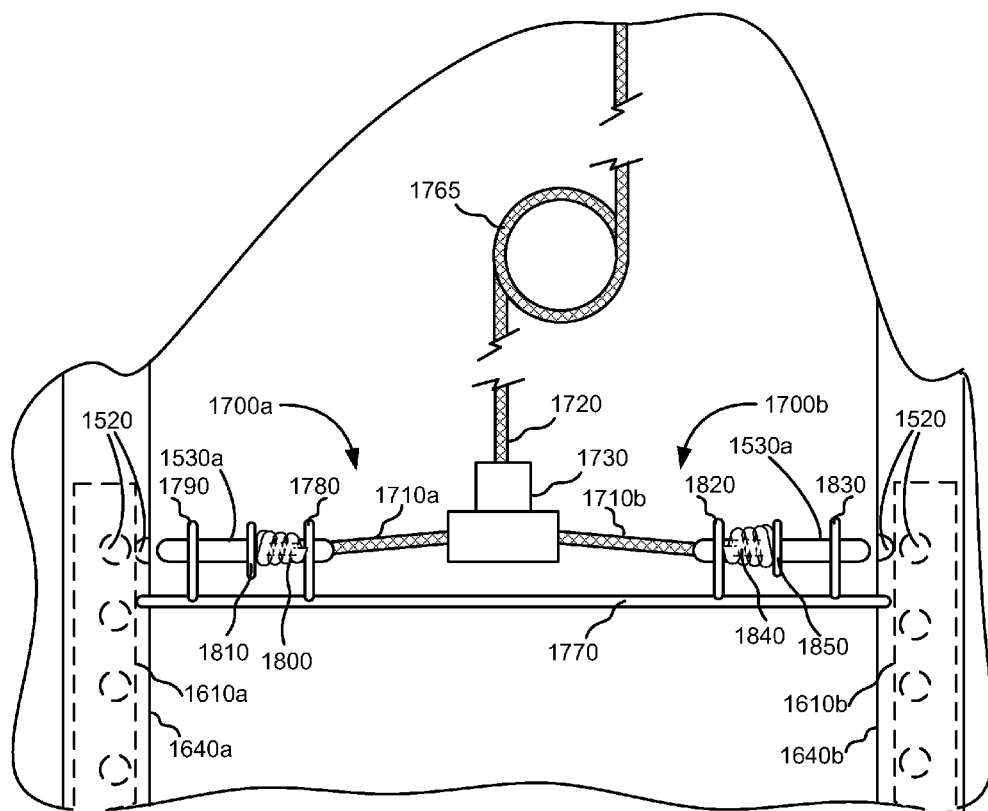
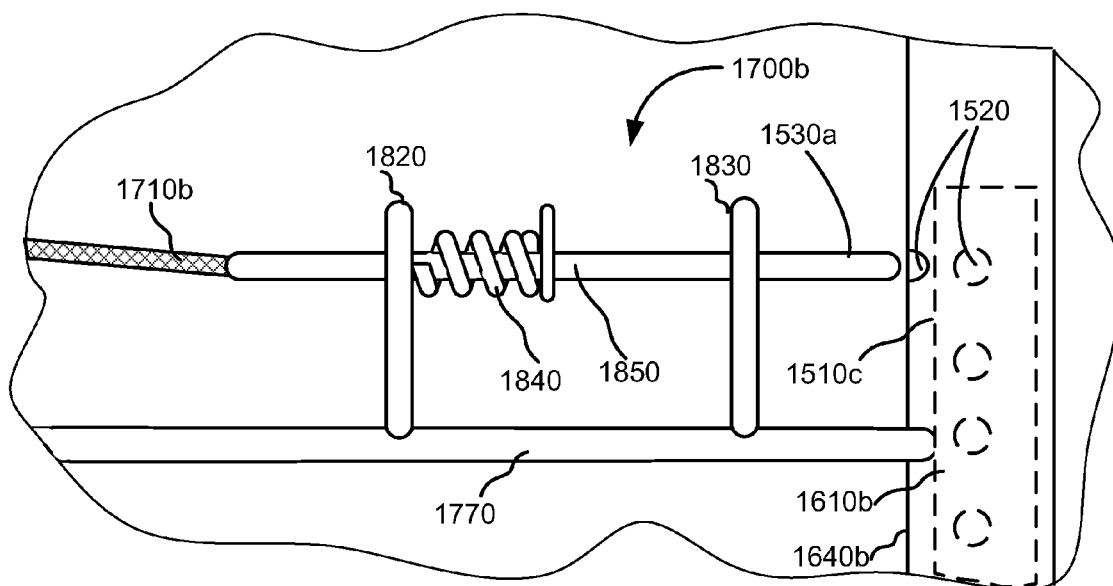


FIG. 17



**FIG. 18**

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# SEGMENTED ADAPTABLE MOBILITY AID DEVICE FOR LEVEL AND INCLINED WALKWAYS AND FOR STAIRS

Application Ser. No. 12/780,870, filed May 15, 2010, and  
entitled ADAPTABLE MOBILITY AID DEVICE FOR  
LEVEL AND INCLINED WALKWAYS AND FOR  
STAIRS, is herein incorporated by reference in its entirety.

## TECHNICAL FIELD

This invention relates generally to mobility aid devices,  
and more particularly to adaptable mobility aid devices.

## BACKGROUND

Reduced mobility is a common plight of individuals with  
lower leg injuries or individuals who are recovering from  
lower leg surgery, particularly older individuals. Walkers  
have been used for decades as aids to improve mobility and  
sometimes as well to promote healing for leg, ankle, and foot  
injuries or surgeries. Typically, a walker has four legs with  
end caps and a structure or frame that surrounds a user's front  
and sides during use. Some walkers include two or more  
wheels or casters instead of end caps to make movement of  
the walker easier. These typical walkers are adequate as walk-  
ing aids, but in many situations, a user must prevent contact  
with the floor by an injured foot or ankle. In these circum-  
stances, a user can use only the good leg for bearing weight.  
Thus, in order to use a typical walker, the user is obliged to use  
a "step-hop-step-hop- . . ." gait with the healthier leg, an  
unnatural and uncomfortable manner of getting around. Fur-  
thermore, hopping can be difficult or impossible for some  
older or heavier individuals.

Besides a user's need to hop, other problems are encoun-  
tered when using a conventional walker. As a prime example,  
due to their design for use on level or flat walkways, walkers  
are generally of little use on stairs. They are unstable and  
unwieldy on stairs at best, and often cannot be used at all on  
stairs, due to the distance separating front and rear legs being  
wider than a typical stair step depth. Moreover, the problem of  
hopping is exacerbated when the individual using a walker  
needs to climb or descend stairs. This can happen frequently,  
since stairs are often encountered when a user visits a doctor's  
office, a physical therapist, and even in some cases, around the  
home.

Various attempts have been made to modify walkers for use  
on stairs. These modified walkers, or other mobility aid  
devices that can be used on stairs, generally have been  
unwieldy and/or unsuitable for use on a flat walkway. For  
example, some mobility aid devices have sets of legs with feet  
or skids at the bases of the legs with the feet or skids parallel  
to the forward direction of motion of the walker. These sets of  
legs and feet are configured to fit on two or three stair steps at  
a time. Some other devices require a complicated series of  
adjustments for the leg lengths to accommodate stair riser  
heights or user height. For example, each leg may require  
loosening of a threaded key or screw to enable adjustment of  
the length of that leg, and retightening of the key or screw to  
prevent subsequent undesired changes in length. Having to do  
this at the foot of a stairway, and then again at the top of a  
stairway, can be arduous for someone required to stand on  
only one leg during the adjustment process.

Some modified walkers have included a pad for support of  
a user's knee or lower leg during use of the walker. These

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walkers are either unsuitable for use on stairs, or are difficult  
to adjust between use on stairs and use on level walkways.

## SUMMARY

A general aspect of the invention is a segmented adaptable  
mobility aid device. The device includes a plurality of inter-  
connectable segments, each segment having at least one aper-  
ture; a pin engageable with the at least one aperture for inter-  
connecting the plurality of interconnectable segments, and  
for securing the plurality of interconnectable segments  
against movement relative to each other; and a support plat-  
form configured to be coupled to a predetermined segment of  
the plurality of interconnectable segments, the support plat-  
form being for providing knee support or for providing a seat.

In some embodiments, the plurality of interconnectable  
segments includes a first segment; a second segment config-  
ured to engage the first segment; and a third segment config-  
ured to engage the second segment. In further embodiments,  
the device further includes a lever mechanism coupled to the  
third segment for adjusting the height of the third segment to  
the height of a stair step or to the incline of a ramp. In yet  
further embodiments, the lever mechanism comprises a pin  
and spring arrangement.

In other further embodiments, the first segment is config-  
ured to receive the support platform thereon.

In other further embodiments, the first segment includes a  
handle including a pair of handle arms; and a first pair of legs  
coupled to respective ones of the pair of handle arms. In still  
further embodiments, the second segment includes a second  
pair of legs configured to engage respective ones of the first  
pair of legs; and a pair of support uprights coupled to the  
second pair of legs, and configured to engage respective ones  
of the pair of handle arms. In yet further embodiments, the  
third segment includes a third pair of legs configured to  
engage respective ones of the pair of support uprights. In still  
yet further embodiments, the device further includes a first  
footer coupled to the second pair of legs for stabilizing the  
second pair of legs on a surface; and a second footer coupled  
to the third pair of legs for stabilizing the third pair of legs on  
the surface.

## BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be more fully understood by reference  
to the detailed description, in conjunction with the accompa-  
nying figures, wherein:

FIG. 1A is an oblique angle view of a preferred embodi-  
ment of the present invention in use as an adaptable mobility  
aid device on a level walkway, showing the device in place in  
a first position and a knee of a user about to be placed on a  
knee support platform;

FIG. 1B is an oblique angle view of the preferred embodi-  
ment of FIG. 1A, showing the bent knee of one leg supported  
by the knee support platform while the user takes a step with  
the good leg, from the first position to a second position;

FIG. 1C is an oblique angle view of the preferred embodi-  
ment of FIG. 1A, showing the bent knee of one leg supported  
by the knee support platform, the user having taken the step  
with the other leg, from the first position to the second posi-  
tion;

FIG. 1D is an oblique angle view of the preferred embodi-  
ment of FIG. 1A, showing the step completed, the user having  
removed the knee from the knee support platform and/or  
shifting his weight to the good leg, and moving the device to  
a third position about a distance of one step ahead of the  
second position;

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FIG. 1E is an oblique angle view of the preferred embodiment of FIG. 1A, showing the device in place in the third position and the knee of the user about to be placed on the knee support platform;

FIG. 2A is an oblique angle view of the preferred embodiment of FIG. 1A, showing the user at the bottom of a stairway, the user having removed the knee from the knee support platform and standing erect on the good leg;

FIG. 2B is an oblique angle view of the preferred embodiment of FIG. 1A, illustrating the device in use as an adaptable mobility aid device on a stairway, and showing placement of the device on the bottom stair of the stairway;

FIG. 2C is an oblique angle view of the preferred embodiment of FIG. 1A, showing the bent knee of one leg supported by the knee support platform while the user takes a step with the good leg, from the bottom of the stair to the adjacent step;

FIG. 2D is an oblique angle view of the preferred embodiment of FIG. 1A, showing the bent knee of one leg supported by the knee support platform, the user having taken the step with the good leg, from the bottom of the stairway to the bottom stair step;

FIG. 2E is an oblique angle view of the preferred embodiment of FIG. 1A, showing the step completed, the user having removed the knee from the knee support platform and moving the device to the next stair step;

FIG. 3 is an oblique angle view of the preferred embodiment of FIG. 1A, showing use of the knee support platform as a seat for resting during climbing or descending stairs;

FIG. 3A is an oblique angle view of the preferred embodiment of FIG. 1A, showing the user at the top of the stairway, the user having removed the knee from the knee support platform and standing erect on the good leg;

FIG. 3B is an oblique angle view of the preferred embodiment of FIG. 1A, showing use of the knee support platform as a seat for resting during use of the device on a walkway, such as the level walkway;

FIG. 4 is an oblique angle view of the embodiment of FIG. 1A, showing the adaptable mobility aid device by itself to better portray the adjustment mechanism by which the length of the front legs can be adjusted;

FIG. 4A is an oblique bottom view of the preferred embodiment of FIG. 1A, showing in more detail the front adjustment mechanism;

FIG. 4B is an oblique angle view of an embodiment showing a portion of a pull bar spring-loaded via a spring-and-flange arrangement;

FIG. 5 is an oblique angle view of a preferred embodiment of the present invention, showing manual attachability and detachability of lower portions of the front legs of a adaptable mobility aid device to enable convertibility between use on a level walkway and use on a stairway;

FIG. 6 is an oblique angle view of a preferred embodiment of the present invention, showing an adjustable coupling configured to be single-hand operable, and showing the adaptable mobility aid device as having two front legs, and two rear legs;

FIG. 7 is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid device with a back support frame, and showing a portion of a front adjustment mechanism, and showing a rear adjustment mechanism;

FIG. 8 is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid device that includes a seat and a back support surface with the seat also adapted for use as a knee support platform;

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FIG. 9 is an oblique angle view of a preferred embodiment of the present invention, showing the front legs, the rear legs, and the knee support platform in cooperation to enable collapsibility of the device;

FIG. 9A is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid device having a pair of front legs including a left front leg and a right front leg, a pair of rear legs including a left rear leg and a right rear leg, and a knee support platform in cooperation to enable collapsibility of the device;

FIG. 10 is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid device having a single adjustable front leg and a single adjustable rear leg;

FIG. 11 is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid device having front legs with front wheels, and rear legs with rear wheels, and a park bar;

FIG. 12A is an oblique angle view of a preferred embodiment showing an adaptable mobility aid device with front leg adjustability via an adjusting bar connected to the front legs;

FIG. 12B is an oblique angle view of a preferred embodiment, showing an adaptable mobility aid device having front leg adjustability via an adjusting bar mounted for sliding motion on support uprights;

FIG. 13 is an oblique angle view of a preferred embodiment showing front leg adjustability via a release handle coupled by a cable to spring loaded pins;

FIG. 13A is a front view showing the release handle of FIG. 13 in more detail;

FIG. 13B is a front view showing a pin actuator of FIG. 13 in more detail;

FIG. 13C is a front view showing a pin and spring arrangement of FIG. 13 in more detail;

FIG. 14 is an oblique angle view of a preferred embodiment similar to that shown in FIG. 5, but with the handle on the side of the device, rather than on the front;

FIG. 15 is an oblique angle view of a preferred embodiment, showing an adaptable mobility aid device with proportions altered for clarity, the adaptable mobility aid device including a plurality of interconnectable segments;

FIG. 16 is an exploded, oblique angle view of the preferred embodiment of FIG. 15 that shows the adaptable mobility aid device with proportions altered for clarity, the adaptable mobility aid device including the plurality of interconnectable segments;

FIG. 17 is a fragmentary view in elevation of an alternative spring arrangement belonging to the preferred embodiment of FIG. 15, this view showing a left pin and spring arrangement and a right pin and spring arrangement; and

FIG. 18 is a fragmentary view in elevation of the alternative spring arrangement belonging to the preferred embodiment of FIG. 15, this view showing an enlarged detail view of the right pin and spring arrangement.

#### DETAILED DESCRIPTION

FIG. 1A through FIG. 1E depict a sequence of steps that illustrate the use of an adaptable mobility aid device in a preferred embodiment on a level walkway.

FIG. 1A is an oblique angle view of a preferred embodiment of the present invention in use as an adaptable mobility aid device **100** on a level walkway **102**, showing the device in place in a first position **106** and a knee **114** of a user **108** about to be placed on a knee support platform **120**. The user **108** of the device **100** is gripping the handle **110** of the device, and is standing erect on a leg **112** with the knee **114** of the other leg

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bent. The leg 112 is hereinafter referred to as the good leg. The adaptable mobility aid device 100 provides stable support at this point in the sequence so that the user 108 can use the device for knee support during movement of the good leg 112.

In the embodiment of FIG. 1A, the device 100 includes a pair of front legs 116a and 116b, a pair of rear legs 118a and 118b, as well as the knee support platform 120. As shown, the handle 110 is coupled to the knee support platform 120. In the embodiments described herein, the front legs 116a and 116b and the rear legs 118a and 118b are coupled to the knee support platform 120. In some preferred embodiments, the front legs 116a and 116b and the rear legs 118a and 118b are configured for frictional contact with a walkway and/or stairway. It is understood that embodiments of the present invention can have fewer than two front legs, for example, at least one front leg, and can have fewer than two rear legs, for example, at least one rear leg. FIG. 10, discussed below, shows an embodiment with one front leg and one rear leg. It is also understood that some embodiments can have three legs. In FIG. 1A, the device has a front side with which the at least one front leg is coupled, and the handle 110 forms a portion of the front side. Moreover, the at least one front leg and at least one rear leg are parallel, one with another.

In FIG. 1A, an adjustment mechanism (402, see FIGS. 4 and 4A), also referred to herein as an adjustability mechanism, can be activated by a spring-loaded pull bar 122 to enable length adjustability of the front legs 116a and 116b. In various preferred embodiments discussed below, the adjustment mechanism includes an adjustable coupling, and is single hand operable through single hand operability of the adjustable coupling. A separate adjustment mechanism 124, likewise also referred to herein as an adjustability mechanism, enables length adjustability of the rear legs 118a and 118b. By use of the adjustment mechanisms 402 and 124, the device 100 can be adjusted so that the knee support platform 120 is at a comfortable height for use by the user 108.

FIG. 1B is an oblique angle view of the preferred embodiment of FIG. 1A, showing the bent knee 114 of one leg supported by the knee support platform 120 while the user 108 takes a step with the good leg 112, from the first position 106 (see FIG. 1A) to a second position 126. As shown in FIG. 1B, the user 108 continues to grip the handle 110 of the device 100, while the bent knee 114 bears the entire weight of the user.

Because the knee support platform 120 supports the knee 114, which supports the weight of the user 108 at this point in the sequence, the user can move the good leg 112 forward to take a step 128 without having to hop from the first position 106 to the second position 126. Moreover, the knee support platform 120 has a flat padded upper surface 130 to provide more comfortable support for the knee 114. In some preferred embodiments the upper surface 130 is contoured rather than flat.

FIG. 1C is an oblique angle view of the preferred embodiment of FIG. 1A, showing the bent knee 114 of one leg supported by the knee support platform 120, the user 108 having taken the step 128 (see FIG. 1B) with the other leg 112, from the first position 106 (see FIG. 1A) to the second position 126 (see FIG. 1B). The user 108 continues to grip the handle 110 of the device 100, while both the good leg 112 and the bent knee 114 can bear the weight of the user.

FIG. 1D is an oblique angle view of the preferred embodiment of FIG. 1A, showing the step 128 (see FIG. 1B) completed, the user 108 having removed the knee 114 from the knee support platform 120 and/or shifting his weight to the good leg 112, and moving 132 the device 100 to a third position 134 about a distance of one step ahead of the second

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position 126 (see FIG. 1B). The user 108 of the device 100 has lifted the device with one hand on the handle 110 of the device, and is standing erect on the good leg 112 with the knee 114 of the other leg bent.

FIG. 1E is an oblique angle view of the preferred embodiment of FIG. 1A, showing the device 100 in place in the third position 134 and the knee 114 of the user 108 about to be placed on the knee support platform 120. The user 108 having taken a step is thus brought to a similar point in the sequence as is shown above in FIG. 1A. In FIG. 1E, the user 108 of the device 100 is gripping the handle 110 of the device, and continues to stand on the good leg 112 with the knee 114 of the other leg bent. The adaptable mobility aid device 100 provides stable support at this point in the sequence so that the user 108 can use the device for knee support during movement of the good leg 112.

FIG. 2A through FIG. 2E depict a sequence of steps that illustrates the use of an adaptable mobility aid device in a preferred embodiment on a stairway.

FIG. 2A is an oblique angle view of the preferred embodiment of FIG. 1A, showing the user 108 at the bottom of a stairway 202, the user 108 having removed the knee 114 from the knee support platform 120 and standing erect on the good leg 112. The user 108 is operating an adjustment mechanism (402, see FIG. 4A) via the spring-loaded pull bar 122 to convert the device 100 from use on the level walkway 102 to use on the stairway 202 by shortening the front legs 116a, 116b as shown by the arrow 204. The adjustment mechanism 402 is single-hand operable via a pull by the user 108 and configured to shorten or lengthen the front legs 116a, 116b in tandem. By use of the adjustment mechanism 402, the device 100 can be adjusted so that the knee support platform 120 is level and remains at a comfortable height for use by the user 108, when the device is used on stairs.

FIG. 2B is an oblique angle view of the preferred embodiment of FIG. 1A, illustrating the device 100 in use as an adaptable mobility aid device on a stairway 202, and showing placement 206 of the device on the bottom stair 207 of the stairway. The user 108 of the device 100 has lifted the device with one hand on the handle 110 of the device, and is standing erect on the good leg 112 with the knee 114 of the other leg bent. For stairway use, the adaptable mobility aid device 100 is configured so that the front legs 116a and 116b (see FIG. 2A) engage an upper step and the rear legs 118a and 118b (see FIG. 1A) engage an adjacent lower step so as to support the knee support platform in a position over a portion of the upper step and over a portion of the adjacent lower step, and with the knee support platform disposed approximately horizontally. It will be appreciated that the device 100 is designed to straddle and span two steps for use on stairs, an aspect of the invention that will be discussed further below in connection with FIG. 2E. As used herein and in the accompanying claims, the term step refers to an upper surface of a stair step as well as a portion of a flat walkway adjacent a stairway.

FIG. 2C is an oblique angle view of the preferred embodiment of FIG. 1A, showing the bent knee 114 of one leg supported by the knee support platform 120 while the user 108 takes 208 a step with the good leg 112, from the bottom of the stair to the adjacent step 207. The user 108 continues to grip the handle 110 of the device 100, while the bent knee 114 bears the entire weight of the user.

Because the knee support platform 120 supports the knee 114, which supports the weight of the user 108 at this point in the sequence, the user can move the good leg 112 forward and upward to advance 208 to the stair step 207 without having to hop from the lower step to the next stair step. Moreover, as



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mentioned previously, the knee support platform **120** has a flat padded upper surface **130** to provide more comfortable support for the knee **114**.

FIG. 2D is an oblique angle view of the preferred embodiment of FIG. 1A, showing the bent knee **114** of one leg supported by the knee support platform **120**, the user **108** having taken the step with the good leg **112**, from the bottom of the stairway **202** to the bottom stair step **207**. The user **108** continues to grip the handle **110** of the device **100**, while both the good leg **112** and the bent knee **114** can bear the weight of the user.

FIG. 2E is an oblique angle view of the preferred embodiment of FIG. 1A, showing the step completed, the user **108** having removed the knee **114** from the knee support platform **120** and moving **210** the device **100** to the next stair step. The user **108** of the device **100** has lifted the device with one hand on the handle **110** of the device, and is standing erect on the good leg **112** with the knee **114** of the other leg bent. It is understood that descending a step can be accomplished by a user by backing down the stairs and performing the steps shown in FIGS. 2A-2E in the reverse order.

As mentioned previously, the device **100** is designed to straddle and span two steps when used on a stairway. The capability of the device **100** to straddle two steps enhances the usability of the device on stairs, and can enhance the stability of a user employing the device, for several reasons. First, in various embodiments, the device **100** has a footprint of about 9 inches square or larger, contributing to its greater stability over currently available adaptable mobility aid devices with smaller footprints that generally rest on only a single step when used on stairs.

Second, during use on a stairway, an exemplary knee support platform is positioned so as to span two steps. Thus, while the user is taking a step, or when the user shifts his or her weight from the good leg, the weight of the user is distributed between the two steps. In this situation, a slight shift of the user's posture brings the majority of the user's weight to bear on the upper step, or on the lower step. This capability to shift the user's weight to the upper step or alternatively the lower step can make it easier for the user to mount or descend stairs.

Third, the positioning of the knee support platform over both steps results in the user's center of gravity being positioned about midway between the two steps. This is a much more natural positioning of the user's center of gravity while the user takes a step from one step to an adjacent step, whether ascending or descending. The more natural position can make it easier for the user to mount or descend stairs.

Fourth, use of the device **100** for descending stairs can better accommodate the frequently limited mobility of the user. The stairway descent is safer in that a user descends the stairs by lowering the good leg **112** first, then the device **100** is transported to the lower step with the weight of the user supported by the good leg. In contrast, when descending stairs using an adaptable mobility aid device that doesn't straddle two steps but instead rests on only a single step, typically a user is obliged to lower the device, and the injured leg, first. The knee of the good leg must be bent during this transition from one step to the lower step, while at the same time, the weight of the user must be borne by the good leg. Then, after the device and injured leg are positioned on the next lower step, a step to the lower step is taken with the good leg. The user may be put in an awkward and unstable position during part of this sequence. Furthermore, this mode of descent can be problematic for uncoordinated and/or elderly individuals.

Thus, by its design for straddling stairs, the device **100** fosters use of a more natural gait by the user during ascent and

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descent of stairs. Moreover, adjustment of the front legs of the device **100** to afford the stability just discussed can be done in seconds without tools, using a single hand to operate the adjustment mechanism.

In many cases, an individual recovering from lower leg surgery or a leg injury can become fatigued by the effort of climbing or descending a staircase. Such individuals may wish to sit for a short time to gain a respite from the effort of climbing or descending. Embodiments of the present invention readily provide such respite from the exertion of stair use. Use of the device **100** as a seat for resting is discussed in connection with FIGS. 3 and 3B.

FIG. 3 is an oblique angle view of the preferred embodiment of FIG. 1A, showing use of the knee support platform **120** (see FIG. 1A) as a seat **306** for resting during climbing or descending stairs. The handle **110** of the device **100**, along with the leg extensions **116c** and **116d**, which act as upright supports for the handle, form a back support frame **308** when the knee support platform **120** is in use as a seat **306**. In this manner a user **108** of the adaptable mobility aid device **100** can recover to some extent from fatigue due to stair climbing or descending.

FIG. 3A is an oblique angle view of the preferred embodiment of FIG. 1A, showing the user **108** at the top of the stairway **202**, the user having removed the knee **114** from the knee support platform **120** and standing erect on the good leg **112**. The user **108** is operating the adjustment mechanism **402** (see FIG. 4A) to convert the device **100** from use on the stairway to use on a flat walkway by lengthening the front legs **116a** and **116b**. As mentioned previously, the adjustment mechanism **402** is single-hand operable, and is configured to lengthen the front legs **116a** and **116b** in tandem. As in FIG. 1E, the adjustment mechanism is operable via a pull of the pull bar **122** by the user **108**, as shown. By use of the adjustment mechanism **402**, the device **100** can be adjusted so that the knee support platform **120** is level and remains at a comfortable height for use by the user **108**, when the device is used on a level walkway.

In many cases, an individual recovering from lower leg surgery or a leg injury can become fatigued even by the effort of walking on a level walkway. Such individuals may wish to sit for a short time to gain a respite from the effort of walking. Embodiments of the present invention readily enable respite from the exertion of walking on a level walkway, as discussed next.

FIG. 3B is an oblique angle view of the preferred embodiment of FIG. 1A, showing use of the knee support platform **120** (see FIG. 1A) as a seat **306** for resting during use of the device **100** on a walkway, such as the level walkway **102** (see FIG. 1A). The handle **110** of the device **100**, along with the leg extensions **116c** and **116d** (see FIG. 3) that form upright supports for the handle, form a back support frame **308** when the knee support platform **120** is in use as a seat **306**. It will be appreciated that adjustability of the front legs enables use of the device **100** as a seat even on an inclined walkway, should a user become fatigued during use of the device on the inclined walkway.

FIG. 4 is an oblique angle view of the embodiment of FIG. 1A, showing the adaptable mobility aid device **100** by itself to better portray the adjustment mechanism **402** by which the length of the front legs **116a** and **116b** can be adjusted. As shown in FIG. 4, the adjustment mechanism **402** includes two sleeves **404a** and **404b** coupled to the knee support platform **120**. The legs **116a** and **116b** are coupled with the handle **110** through leg extensions **116c** and **116d**. In the preferred embodiment of FIG. 1A, the legs **116a** and **116b**, and the leg extensions **116c** and **116d**, have the same diameter, and are

configured to nest within the sleeves **404a** and **404b**. Ordinarily, the legs and leg extensions **116a** through **116d** are locked in position until the adjustment mechanism **402** is activated. It is understood that leg adjustability can be enabled in other ways, for example, each leg may be configured as a rail sliding inside a groove or larger rail, and nesting need not mean only complete surrounding by the sleeve, but alternatively may encompass the interlocking of sliding rails as just described.

The adjustment mechanism **402** is activated when a pull on the pull bar **122** is communicated to the adjustment mechanism **402** by the linkage **406**. The spring-loading of the pull bar **122** may be accomplished through the linkage **406** of the pull bar with, for example, spring-loaded pins (see FIG. 4A). When the adjustment mechanism is activated, the legs **116a** and **116b** can be lengthened or shortened together by a push down or pull up on the handle **110**. That is, the leg **116a** and the leg extension **116c** have a fixed combined length **408**. Similarly, the leg **116b** and the leg extension **116d** have the same fixed combined length **408**. Thus, a push down on the handle **110** when the adjustment mechanism **402** is activated increases the length of the legs **116a** and **116b** below the knee support platform **120**, while decreasing the lengths of the leg extensions **116c** and **116d** above the knee support platform. Conversely, a pull up on the handle **110** when the adjustment mechanism **402** is activated decreases the length of the legs **116a** and **116b** below the knee support platform **120**, while increasing the lengths of the leg extensions **116c** and **116d** above the knee support platform.

It will be appreciated that other adjustment mechanisms having adjustable couplings can be adapted for use on an adaptable mobility aid device **100** by skilled artisans without undue experimentation. An adaptable mobility aid device that incorporates any such adjustment mechanism and/or adjustable coupling, and that embodies the inventive concepts described herein of straddling two adjacent steps during stairway use, is within the scope of the present disclosure. Preferred embodiments of the present invention that include alternative adjustment mechanisms and/or adjustable couplings are described in detail below.

In some alternative embodiments, the actuator for the adjustment mechanism may be positioned close to the front legs **116a** and **116b**, rather than close to the rear legs **118a** and **118b** as shown by the pull bar **122** and linkage **406**. These details are discussed further in connection with FIG. 4A. Also, in some of these alternative embodiments, the legs **116a** and **116b** have a smaller diameter than the leg extensions **116c** and **116d**, and are configured to nest within the leg extensions, as well as nesting within the sleeves **404a** and **404b**. A crosspiece or crossbar **410** enables sliding of the legs **116a** and **116b** in tandem when the adjustment mechanism **402** is activated.

FIG. 4A is an oblique bottom view of the preferred embodiment of FIG. 1A, showing in more detail the front adjustment mechanism **402**. The adjustment mechanism **402** includes a pair of sleeves **404a** and **404b** coupled to the knee support platform **120**, each sleeve receiving a corresponding front leg **116a** and **116b**, respectively, for sliding motion unless the motion is restrained by a pin, for example, the pins **412a** and **412b**. Each of the pins **412a** and **412b** restrains sliding motion by interlocking with one of a series **414a** or **414b** of apertures in its corresponding leg **116a** or **116b**. The pins **412a** and **412b** are operated together for disengagement from their corresponding apertures by actuation of a spring-loaded bar **122**. Moreover, various preferred embodiments can include a front crossbar or crosspiece **410** by which the front legs can be moved together in tandem. The bar **122** may be spring-loaded

via one or more springs **418** positioned in, for example, slots or recesses **420** within the rear legs **118a** and/or **118b**.

FIG. 4B is an oblique angle view of an embodiment showing a portion of a pull bar spring-loaded via a spring-and-flange arrangement. In embodiment of FIG. 4B, the pull bar **122** or linkage **406** (see FIG. 4A) may be spring-loaded via one or more spring-and-flange arrangements **424** through which the sides of the pull bar traverse under the knee support platform **120**, guiding the bar and keeping it tensioned. In some other embodiments, the pins **412a** and **412b** themselves can be spring-loaded, for example, by springs within the sleeves **404a** and **404b**, with the spring-loading of the pins providing corresponding spring-loading of the pull bar **122** via the linkage **406**.

Resuming the discussion of FIG. 4A, it also shows a rear adjustment mechanism **422**, that is single-hand operable, for example, via a push button **426**. In preferred embodiments the rear legs **118a** and **118b** are connected by a rear crossbar **428** to enable tandem motion of the rear legs to adjust their length. Details of the rear adjustment mechanism are discussed below in connection with FIG. 7.

In some preferred embodiments of the present invention, the front legs may be attachable and detachable manually, for example, by using a cross bar to manipulate lower, detachable portions of the legs in tandem. FIG. 5 is an oblique angle view of a preferred embodiment of the present invention, showing attachability and detachability of lower portions **502a** and **502b** of the front legs **504a** and **504b** of an adaptable mobility aid device **500** to enable convertibility between use on a level walkway **102** (see FIG. 1A) and use on a stairway **202** (see FIG. 2A). In FIG. 5, the lower portions **502a** and **502b** of the front legs **504a** and **504b** are joined with a cross bar **506** to form an H-shaped structure, so that the lower portions of the front legs may be removed from corresponding sleeves **508a** and **508b** in the upper portions **510a** and **510b** of the front legs by pulling on the cross bar, thus shortening the front legs for use on stairs. Conversely, the legs can be lengthened by reversing the process to restore the lower portions **502a** and **502b** of the front legs **504a** and **504b** to nest in the sleeves **508a** and **508b**, so that the front legs **504a** and **504b** are of a length suitable for use on a level walkway. In this way the cross bar **506**, sleeves **508a** and **508b**, and nesting lower portions **502a** and **502b** together comprise an adjustable coupling **512** that is single-hand operable to adjust the length of the front legs **504a** and **504b**.

FIG. 6 is an oblique angle view of a preferred embodiment of the present invention, showing an adjustable coupling **602** configured to be single-hand operable, and showing the adaptable mobility aid device **600** as having two front legs **604a** and **604b**, and two rear legs **606a** and **606b**. Each of the front legs **604a** and **604b** includes a corresponding nesting portion **610a** and **610b**, and a corresponding sleeve portion **608a** and **608b** coupled to the nesting portion via the adjustable coupling **602**. It is understood that the rear legs **606a** and **606b** may in addition have an adjustable coupling configured to be single-hand adjustable, so that the rear legs are length-adjustable as well (see, for example, FIG. 7).

As shown in FIG. 6, the adjustment mechanism includes a spring-loaded tab **612** on a connecting rod **614** that couples with two pins **616a** and **616b**. The spring loading is such that each pin **616a** and **616b** is normally urged into an aperture on the series **618a** and **618b** of apertures, if an aperture is available for engagement with the pin. The tab **612** can be pivoted on for example, a mounting protrusion or tongue **620** attached to a frame that supports the knee support platform **120** (see FIG. 1A), or to a horizontal support bar **622** fastened at each end to upright supports **624a** and **624b**. Pressing the tab **612**

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against the spring loading disengages the pins **616a** and **616b** from their respective apertures so that the front legs **604a** and **604b** can be shortened or lengthened as desired by sliding the front legs into or out of the upright supports **624a** and **624b** for the handle **626**. Furthermore, in various embodiments a crossbar **628** connects the front legs **604a** and **604b** to enable sliding motion of the front legs in tandem.

In some other embodiments, the adjustment mechanism includes only a single sleeve and corresponding pin, that couple with a central shaft connected to the two front legs **604a** and **604b**. The central shaft includes a series of apertures that can mate with the pin to normally restrain motion of the central shaft. Activating the adjustment mechanism via a spring loaded tab enables motion of the central shaft within its sleeve, and thereby enables motion of the legs **604a** and **604b** within the upright supports **624a** and **624b**.

FIG. 7 is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid device **700** with a back support frame **702**, and showing a portion of a front adjustment mechanism **704**, and showing a rear adjustment mechanism **706**. Each of the adjustment mechanisms **704** and **706** is configured for single-hand operability and configured to enable length adjustment of two legs alone or in tandem, that is front legs **708a** and **708b** alone or in tandem, and rear legs **710a** and **710b** alone or in tandem. The front legs **708a** and **708b** are capable of adjustment to a first length for use on stairs, and to a second length for use on a level walkway. In the preferred embodiment of FIG. 7, the device **700** also includes a knee support platform **712** coupled to the pair of front legs **708a** and **708b**, coupled to the pair of rear legs **710a** and **710b**, and coupled to the back support frame **702**. In addition, the device **700** includes a handle **714** coupled to the back support frame **702**. The knee support platform **712** has a flat upper surface **716**, and is also adapted for use as a seat (**306**, see FIG. 3). As shown, the handle **714** is positioned so that it is on an opposite side of the knee support platform **712** when the device **700** is in use for walking or climbing (see, for example, FIGS. 1A-1E and FIGS. 2B-2E).

The rear adjustment mechanism **706** includes a cylindrical shell **718** that connects two sleeves **720**. The shell **718** also contains spring loaded shafts (not shown) coupled to pins disposed within the sleeves **720**. A push button **722** protrudes from the center of the shell **718**, and is coupled to the spring loaded shafts so that a push of the push button results in withdrawal of each pin from one of a series of apertures **724** in the upper portions **726a** and **726b** of the legs. The upper portions **726a** and **726b** of the legs **710a** and **710b** are received within the sleeves **720** and nest within the lower portions **728a** and **728b** of the legs. In this manner the legs **710a** and **710b** can be adjusted to various lengths by a push of the push button **722** and motion of the cylindrical shell **718** to slide the lower portions **728a** and **728b** of the legs toward or away from the knee support platform **712**. The construction and operation of the front adjustment mechanism **704** is similar.

FIG. 8 is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid device **800** that includes a seat **802** and a back support surface **804**. In addition to sitting, the seat **802** is adapted for use as a knee support platform **120** (see, for example, FIGS. 1A-1D). The embodiment of FIG. 8 also includes an adjustment mechanism **806** that can enable length adjustment in tandem of a pair of front legs **808a** and **808b** of the device **800**, and that is single-hand operable. As with the other embodiments discussed in this disclosure, the front legs **808a** and **808b** are configured to engage a walking surface by frictional contact.

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In addition, the front legs **808a** and **808b** can be adjusted to a first length for use on stairs and to a second length for use on a level walkway.

The adaptable mobility aid device **800** also includes a pair of rear legs **810a** and **810b** which are configured to engage a walking surface by frictional contact. The rear legs **810a** and **810b** can be length-adjustable in tandem via single-hand operability (see, for example, FIG. 7). In addition, the device **800** includes a handle **812** that is coupled to the back support surface **804**. As shown, the handle **812** is positioned so that it is on an opposite side of seat **802** when the device **800** is in use for walking or climbing where the seat is used as a knee support platform (see, for example, FIGS. 1A-1D and FIGS. 2B-2E). Also as shown in FIG. 8, the seat **802** is also coupled to the back support surface **804**, as well as being coupled to the pair of front legs **808a** and **808b**, and to the pair of rear legs **810a** and **810b**. Moreover, in the preferred embodiment of FIG. 8, the handle **812** is coupled to the pair of front legs **808a** and **808b**, and is coupled to the back support surface **804** through the coupling of the handle to the pair of front legs.

In analogy with the embodiment shown in FIG. 6, the adjustability mechanism **806** is configured to enable length adjustment of the pair of front legs **808a** and **808b**, and configured for single-hand operability. Each of the front legs **808a** and **808b** includes a corresponding nesting portion **816a** and **816b**, and a corresponding sleeve portion **818a** and **818b** coupled to the nesting portion via the adjustable coupling **806**. It is understood that the rear legs **810a** and **810b** may in addition have an adjustable coupling configured to be single-hand adjustable, so that the rear legs are length-adjustable as well (see, for example, FIG. 7).

As shown in FIG. 8, the adjustability mechanism **806** includes a spring-loaded tab **820** on a connecting rod **822** that couples with two pins **824a** and **824b**. The spring loading is such that each pin **824a** and **824b** is normally urged into an aperture of the series **826a** and **826b** of apertures, if an aperture is available for engagement with the pin. The tab **820** can be pivoted on for example, a mounting protrusion or tongue **828** attached to a frame that supports the knee support platform **802**, or to a horizontal support bar **830** fastened at each end to upright supports **832a** and **832b** that couple the handle **812** to the front legs **808a** and **808b**. Pressing the tab **820** against the spring loading disengages the pins **824a** and **824b** from their respective apertures so that the front legs **808a** and **808b** can be shortened or lengthened as desired by sliding the front legs into or out of the upright supports **832a** and **832b** for the handle **812** and back support surface **804**. Furthermore, in some embodiments a crossbar **628** (see FIG. 6) connects the front legs **808a** and **808b** to enable sliding motion of the front legs in tandem.

FIG. 9 is an oblique angle view of a preferred embodiment of the present invention, showing the walking aid device **900** having a pair of front legs including a left front leg **902a** and a right front leg **902b**, a pair of rear legs including a left rear leg **904a** and a right rear leg **904b**, and a knee support platform **906** in cooperation to enable collapsibility of the device. For clarity, details of the front and rear adjustment mechanisms have been omitted from FIG. 9. The knee support platform **906** can pivot with respect to the legs **902a**, **902b**, **904a**, and **904b**, and the device **900** is caused to collapse by bending of a left crossbrace **908a** and a right crossbrace **908b** that connect corresponding front and rear legs.

In the embodiment of FIG. 9, the left crossbrace **908a** is pivotally attached to the left front leg **902a** and pivotally attached to the left rear leg **904a**. The left crossbrace **908a** includes a pivot **910** within a central portion of the left crossbrace to enable bending of the left crossbrace. Similarly, the

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right crossbrace **908b** is pivotally attached to the right front leg **902b** and pivotally attached to the right rear leg **904b**, the right crossbrace including a pivot (not shown) within a central portion of the right crossbrace to enable bending of the right crossbrace. A rod **912** having a left end **914a** and a right end **914b** is connected to the left crossbrace **908a** at the left end **914a** to form the pivot **910** of the left crossbrace, and connected to the right crossbrace **908b** at the right end **914b** to form the pivot of the right crossbrace. In this manner, a motion of the rod **912**, for example, a pull downward on the rod, so as to cause bending of the left crossbrace **908a** and the right crossbrace **908b**, enables folding of the device **900** for storage, for example, in a closet or other storage area, or in an automobile or other vehicle. It will be appreciated that in some embodiments a folded adaptable mobility aid device **900** may also function as a cane.

FIG. 9A is an oblique angle view of a preferred embodiment of the present invention, similar in some respects to the embodiment of FIG. 9, showing an adaptable mobility aid device **900'** having a pair of front legs including a left front leg **902a** and a right front leg **902b**, a pair of rear legs including a left rear leg **904a** and a right rear leg **904b**, and a knee support platform **916** in cooperation to enable collapsibility of the device. For clarity, details of the front and rear adjustment mechanisms have been omitted from FIG. 9A. The knee support platform **916** can pivot with respect to the legs **902a**, **902b**, **904a**, and **904b**. The knee support platform **916** differs from knee support platform **906** of the embodiment of FIG. 9 in that the knee support platform **916** is foldable, as shown. The device **900'** is caused to collapse by bending of a left crossbrace **908a** and a right crossbrace **908b** that connect corresponding front and rear legs. By being foldable, the knee support platform **916** can work together with floating clamps **918a** and **918b** to enable collapsibility of the adaptable mobility aid device **900'**.

In the embodiment of FIG. 9A (as with the embodiment of FIG. 9), the left crossbrace **908a** is pivotally attached to the left front leg **902a** and pivotally attached to the left rear leg **904a**. The left crossbrace **908a** includes a pivot **910a** within a central portion of the left crossbrace to enable bending of the left crossbrace. Similarly, the right crossbrace **908b** is pivotally attached to the right front leg **902b** and pivotally attached to the right rear leg **904b**, the right crossbrace including a pivot **910b** within a central portion of the right crossbrace to enable bending of the right crossbrace. A rod **912** having a left end **914a** and a right end **914b** is connected to the left crossbrace **908a** at the left end **914a** to form the pivot **910a** of the left crossbrace, and connected to the right crossbrace **908b** at the right end **914b** to form the pivot **910b** of the right crossbrace.

As mentioned above, the knee support platform **916** is foldable. At the same time, the floating clamps **918a** and **918b** can slide along the corresponding front legs **902a** and **902b**, respectively, to accommodate the folding of the knee support platform **916**. The floating clamps **918a** and **918b** may include, for example, a plastic insert **920** that reduces friction between the clamp and the leg, while providing a relatively tight fit between the clamp and the leg. In this manner, a motion of the rod **912**, for example, a pull upward on the rod, so as to cause bending of the left crossbrace **908a** and the right crossbrace **908b** enables, folding of the device **900'** for storage, for example, in a closet or other storage area, or in an automobile or other vehicle. It will be appreciated that in some embodiments a folded adaptable mobility aid device **900'** may also function as a cane.

FIG. 10 is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid

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device **1000** having a single adjustable front leg **1002** and a single adjustable rear leg **1004**. Each of the front leg **1002** and the rear leg **1004** include a broad support element **1006** and **1008**, respectively, at its base to provide lateral stability to the device **1000**. The front leg **1002** and the rear leg **1004** can be adjustable via any of the adjustability mechanisms previously described and suitably modified for use with a single leg rather than with legs in tandem. In this embodiment, the knee support platform **1010** is also tilted slightly upwards in the direction from the rear leg towards the front leg. This may be desirable for some users who do not wish to bend their knee at a full 90 degree angle, for example.

FIG. 11 is an oblique angle view of a preferred embodiment of the present invention, showing an adaptable mobility aid device **1100** having front legs **1102a** and **1102b** with front wheels **1104a** and **1104b**, and rear legs **1106a** and **1106b** with rear wheels **1108a** and **1108b**. A park bar **1110** can be operated by a lever **1112** near the handle **1114** to lock the front wheels **1104a** and **1104b** to prevent their movement when the device **1100** is used on stairs, or in other situations where rolling of the device is undesirable. The lever **1112** operates a cable **1116** to disengage the park bar **1110** from the front wheels **1104a** and **1104b**. The park bar **1110** is normally pressed into contact with the front wheels **1104a** and **1104b** by springs **1118a** and **1118b** disposed in slots **1120a** and **1120b** to resist motion of the front wheels. For clarity, details of the front and rear adjustment mechanisms are omitted from FIG. 11.

FIG. 12A is an oblique angle view of a preferred embodiment showing an adaptable mobility aid device **1200** with front leg adjustability via an adjusting bar **1202** connected to the front legs **1204a** and **1204b**, the adjusting bar acting as an adjustment mechanism **1205**, as explained below. The front legs **1204a** and **1204b** are adapted to slide within support uprights **1206a** and **1206b** that include slots **1208a** and **1208b** to accommodate the adjusting bar **1202**. The support uprights **1206a** and **1206b** also include apertures **1210** to receive pins **1212a** and **1212b** that can maintain the front legs **1204a** and **1204b** at a suitable length for stair use, or for use on a level walkway.

In more detail, the front legs **1204a** and **1204b** can slide via sleeves **1214a** and **1214b** within the support uprights **1206a** and **1206b**. Springs **1213a** and **1213b**, or other energy storage devices, for example, energy storage devices having pneumatic or hydraulic arrangements, provide a restoring force to the interior portions **1215a** and **1215b** of the front legs **1204a** and **1204b**, respectively, that slide within the support uprights **1206a** and **1206b**.

When the user on a level walkway arrives at a stairway, the user can place the device **1200** on the stairway so as to straddle both the end of the level walkway and the first step of the stairway. After the user activates the adjustment mechanism **1205**, the weight of a user on the knee support platform **120** (see FIG. 1A) can force the front legs **1204a** and **1204b** to adjust to the appropriate leg length for stair use. When the user wishes to resume motion on a level walkway, the device **100** can be converted back to flat walkway use by lifting the knee **114** (see FIG. 1A) slightly from the knee support platform **120** and activating the adjustment mechanism **1205**. The springs **1213a** and **1213b** then can exert force against the interior portions **1215a** and **1215b** to extend the front legs **1204a** and **1204b**. In this manner the device **1200** enables single hand adjustability of the length of the front legs **1204a** and **1204b**.

The adjustment mechanism **1205** includes a push button **1216** on the adjusting bar **1202** that can move **1217** a cam **1218** coupled to spring-loaded rods **1220a** and **1220b** that end

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with the pins **1212a** and **1212b**. Motion of the cam can draw the pins **1212a** and **1212b** from the apertures **1210** to enable the front legs **1204a** and **1204b** to slide for length adjustment. The spring loading of the pins **1212a** and **1212b** may be accomplished, for example, by spring and flange arrangements **1222a** and **1222b**. It is understood that the rear legs **1224a** and **1224b** may be length adjustable as described above in connection with other embodiments.

FIG. **12B** is an oblique angle view of a preferred embodiment, similar in some respects to the embodiment of FIG. **12A**, showing an adaptable mobility aid device **1200** having front leg adjustability via an adjusting bar **1226** mounted for sliding motion on support uprights **1228a** and **1228b**. The front legs **1230a** and **1230b** are adapted to slide within the support uprights **1228a** and **1228b**, and include apertures, some of which are shown in dashed outline at **1232a** and **1232b**, that can mate with pins **1234a** and **1234b** operated via the adjusting bar **1226**. The apertures **1232a** and **1232b** and pins **1234a** and **1234b** can maintain the front legs **1230a** and **1230b** at a suitable length for stair use, or for use on a level walkway. The adjusting bar **1226** is mounted near a handle **1236** for convenience of use.

As discussed above in connection with FIG. **12A**, the front legs **1204a** and **1204b** can slide via sleeves **1214a** and **1214b** within the support uprights **1206a** and **1206b**. Springs **1213a** and **1213b**, or other energy storage devices, for example, energy storage devices having pneumatic or hydraulic arrangements, provide a restoring force to the interior portions **1215a** and **1215b** of the front legs **1204a** and **1204b**, respectively, that slide within the support uprights.

When the user on a level walkway arrives at a stairway, the user can place the device **1200** on the stairway so as to straddle both the end of the level walkway and the first step of the stairway. After the user activates the adjustment mechanism, the weight of a user on the knee support platform can force the front legs to adjust to the appropriate leg length for stair use. When the user wishes to resume motion on a level walkway, the device **1200** can be converted back to flat walkway use by lifting the knee **114** slightly from the knee support platform and activating the adjustment mechanism. The springs **1213a** and **1213b** then can exert force against the interior portions **1215a** and **1215b** to extend the front legs **1204a** and **1204b**. In this manner the device **1200** enables single hand adjustability of the length of the front legs.

The adjusting bar **1226** is coupled to the pins **1234a** and **1234b** by rods **1238a** and **1238b** mounted on the support uprights **1228a** and **1228b** and capable of sliding motion along the support uprights. The rods **1238a** and **1238b** are pivotally connected to motion transfer plates **1240a** and **1240b** on which the pins **1234a** and **1234b** are mounted. The motion transfer plates **1240a** and **1240b** are mounted on a cross member **1242** at pivots **1243a** and **1243b**. An upward motion of the adjusting bar **1226** can thus result in rotation **1244** of the motion transfer plates **1240a** and **1240b** to withdraw the pins **1234a** and **1234b** from apertures in the front legs **1230a** and **1230b** currently mated with the pins, thus enabling the front legs to slide for length adjustability. Springs **1246a** and **1246b** coupled to an anchor member **1248** and to the motion transfer plates **1240a** and **1240b** provide a restoring force to allow the pins **1234a** and **1234b** to once again mate with available apertures on the front legs **1230a** and **1230b**. It is understood that the rear legs **1224a** and **1224b** may be length adjustable as described above in connection with other embodiments. It will also be appreciated that springs similar to **1213a** and **1213b** may be included in an adjustment mechanism for the rear legs **1224a** and **1224b**.

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FIG. **13** is an oblique angle view of an embodiment of the present invention, showing an adaptable mobility aid device **1300** that affords single hand adjustability of the front legs **1302a** and **1302b** via a release handle coupled by a cable to spring loaded pins. The device **1300** also includes rear legs **1304a** and **1304b**, a handle **1306**, a knee support platform **1308**, and an adjustment mechanism **1310**. The rear legs **1304a** and **1304b** can also be adjustable via a rear leg adjustment mechanism, for example, one similar to rear adjustment mechanism **422** (see FIG. **4A**) or rear adjustment mechanism **706** (see FIG. **7**). The rear legs **1304a** and **1304b** are connected with the front legs **1302a** and **1302b** via reinforcing members **1311a** and **1311b** connected by a cross member **1311c**. The reinforcing members **1311a** and **1311b** are shown with doglegs or offsets **1313a** and **1313b** that enable greater adjustability of the rear legs.

The adjustment mechanism **1310** includes adjustable couplings in sleeves **1312a** and **1312b**, left and right pin and spring arrangements **1314a** and **1314b**, respectively, and a release handle **1316** connected by a cable **1318** to a pin actuator **1320**. In various embodiments a rod may be used in place of the cable **1318**.

The front legs **1302a** and **1302b** are configured to slide within support uprights **1322a** and **1322b**. The front legs **1302a** and **1302b** are coupled with the handle **1306** so that raising the handle raises the front legs, effectively shortening them. To lengthen the legs **1302a** and **1302b**, the handle **1306** can be pushed down. If the adjustment mechanism **1310** is not actuated, the front legs are held in position with respect to the adjustable couplings **1312a** and **1312b** by the left and right pin and spring arrangements **1314a** and **1314b** that engages apertures in the support uprights **1322a** and **1322b** and apertures (not shown) in the front legs **1302a** and **1302b**.

The adjustment mechanism **1310** is actuated via operation of the release handle **1316**. FIG. **13A** is a front view showing the release handle **1316** of FIG. **13** in more detail. As shown in FIG. **13A**, the release handle **1316** is slidably coupled with the support uprights **1322a** and **1322b** by guides **1324a-1324d** coupled to the support uprights. A crossbar, referred to herein as a lower handle **1326**, is coupled to the support uprights **1322a** and **1322b**. A user **108** (see FIG. **1A**) of the device **1300** can hold both the lower handle **1326** and the release handle **1316**. By squeezing the release handle **1316** toward the lower handle **1326**, the user **108** can draw the release handle upward, thereby drawing the end of the cable **1318** upward.

FIG. **13B** is a front view showing the pin actuator **1320** of FIG. **13** in more detail. As shown in FIG. **13B**, the other end of the cable **1318** is connected to the pin actuator **1320** at a saddle **1328**. The pin actuator **1320** includes a first lever **1330a** and a second lever **1330b** pivotally mounted to a crosspiece **1332** via pivots **1334a** and **1334b**.

The first lever **1334a** includes a first inside arm **1336** and a first outside arm **1338**. The second lever **1330b** includes a second inside arm **1340** and a second outside arm **1342**. The first outside arm **1338** secures one end of a left cable **1344a** connected to the left pin and spring arrangement **1314a**. The second outside arm **1342** secures one end of a right cable **1344b** connected to the right pin and spring arrangement **1314b**. The denotations left and right typically refer to the perspective of a user using the device **1300**.

One end of a transfer cable **1346** is connected to the first inside arm **1336**. The other end of the transfer cable **1346** is connected to the second inside arm **1340**. The saddle **1328** holds a middle portion of the transfer cable, and thus enables transfer of force from the cable **1318** to the transfer cable **1346**. In alternative embodiments the first and second levers

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1330a and 1330b can be replaced with two pulleys, with a longer transfer cable that engages the two pulleys and also replaces the cables 1344a and 1344b.

With this configuration, when the user 108 (see FIG. 1A) draws the release handle 1316 upward, the cable 1318, via the transfer cable 1346, draws the inside arms 1340 and 1336 upward, which results in the outside arms 1342 and 1338 drawing the ends of the cables 1344a and 1344b toward one another and away from their nearest supports upright 1322a and 1322b, respectively, as shown by the arrows 1350a and 1350b. The motions of the cables 1344a and 1344b are communicated to the pins of the pin and spring arrangements 1314a and 1314b, discussed next.

FIG. 13C is a front view showing the pin and spring arrangement 1314a of FIG. 13 in more detail. As shown in FIG. 13C, the left pin and spring arrangement 1314a includes a holding bracket 1354 that spans the two support uprights 1322a and 1322b. The holding bracket includes two vertical members 1356 and 1358 for the left pin and spring arrangement 1314a, through which a pin 1360 passes. A ring 1362 at one end of the pin 1360 connects the pin with the other end of the cable 1344a. A spring 1366 encircles the pin 1360, and is positioned between the vertical member 1356 and a washer 1364 fixed to the pin. When the cable 1344a is drawn away from the support upright 1322a a sufficient distance, the pin 1360 is drawn out of an aperture 1368, and the washer 1364 compresses the spring 1366 against the vertical member 1356. Thus, when the pin actuator 1320 is no longer activated, that is, when the user 108 (see FIG. 1A) releases the release handle 1316, the energy stored in the compressed spring 1366 can be released, with the pin 1360 moving back into the aperture 1368. When the pin 1360 moves back into the aperture 1368, the pin can engage one of a series of apertures similar to the series 618a (see FIG. 6) but disposed on the leg 1302a so as to align with the aperture 1368, and the pin can thereby secure the left leg against sliding within the support upright 1322a. The right pin and spring arrangement 1314b is configured similarly.

In other embodiments, interior springs 1213a and 1213b (see FIG. 12A), or other energy storage devices, for example, energy storage devices having pneumatic or hydraulic arrangements, provide a restoring force to interior portions 1215a and 1215b of the front legs 1302a and 1302b, respectively, that slide within the support uprights 1322a and 1322b.

Thus, in these other embodiments, when the user 108 (see FIG. 1A) on a level walkway arrives at a stairway, the user can place the device 1300 on the stairway so as to straddle both the end of the level walkway and the first step of the stairway. After the user activates the adjustment mechanism 1310, the weight of a user on the knee support platform 1308 can force the front legs 1302a and 1302b to adjust to the appropriate leg length for stair use. When the user 108 wishes to resume motion on a level walkway, the device 1300 can be converted back to flat walkway use by lifting the knee 114 slightly from the knee support platform 1308 and activating the adjustment mechanism 1310. The springs 1213a and 1213b (see FIG. 12A) then can exert force against the interior portions 1215a and 1215b of the front legs 1302a and 1302b to extend the front legs. In this manner the device 1300 enables single hand adjustability of the length of the front legs 1302a and 1302b.

FIG. 14 is an oblique angle view of a preferred embodiment similar to that shown in FIG. 5, but with the handle 1401 on the side of the device 1400, rather than on the front. As with the embodiment of FIG. 5, the front legs 1404a and 1404b may be attachable and detachable manually, for example, by using a cross bar to manipulate lower, detachable portions of the legs in tandem. In FIG. 14, the lower portions 1402a and

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1402b of the front legs 1404a and 1404b are joined with a cross bar 1406 to form an H-shaped structure, so that the lower portions of the front legs may be removed from corresponding sleeves 1408a and 1408b in the upper portions 1410a and 1410b of the front legs by pulling on the cross bar, thus shortening the front legs for use on stairs. Conversely, the legs can be lengthened by reversing the process to restore the lower portions 1402a and 1402b of the front legs 1304a and 1404b to nest in the sleeves 1408a and 1408b, so that the front legs 1404a and 1404b are of a length suitable for use on a level walkway. In this way the cross bar 1406, sleeves 1408a and 1408b, and nesting lower portions 1402a and 1402b together comprise an adjustable coupling 1412 that is single-hand operable to adjust the length of the front legs 1404a and 1404b.

Referring to FIGS. 15 and 16, there is shown a preferred embodiment of a segmented adaptable mobility aid device, generally referred to as 1500, particularly for use on stairway 202 (see FIG. 2A). Segmented adaptable mobility aid device 1500 may also be used on level or inclined walkway 102 (see FIG. 2A), if desired. As shown in FIGS. 15 and 16, segmented adaptable mobility aid device 1500 includes a plurality of vertically aligned, interconnectable segments comprising a first segment 1510a, a second segment 1510b and a third segment 1510c. Segments 1510a/1510b/1510c are stackable end-to-end and alignable generally along a vertical axis 1515 for reasons described hereinbelow. Although three interconnectable segments 1510a, 1510b and 1510c are shown, it should be appreciated that the invention is not limited to three interconnectable segments. More than three interconnectable segments may be provided, if desired, and configured according to the teachings herein. However, at least two interconnectable segments are required, so that segmented adaptable mobility aid device 1500 is height-adjustable for accommodating the height of user 108 and for ascending or descending stairway 202.

Referring again to FIGS. 15 and 16, at least one of the segments 1510a/1510b/1510c has at least one aperture 1520 for reasons described presently. In this regard, a plurality of pins, such as first pins 1530a, second pins 1530b and third pins 1530c, engage respective ones of apertures 1520 for interconnecting segments 1510a/1510b/1510c and for securing segments 1510a/1510b/1510c against movement relative to each other. Pins 1530a may be spring-loaded, so that pins 1530a can be manipulated by means of a cable and spring arrangement, generally referred to as 1535. Cable and spring arrangement 1535 is described in detail hereinbelow. Pins 1530b and 1530c are manipulated manually rather than by a cable and spring arrangement. More specifically, pins 1530b and 1530c are caused to engage selected ones of apertures 1520 in a manner that adjusts the height of first segment 1510a to the height of second segment 1510b. After pins 1530a and pins 1530b engage their respective apertures 1520, the pins 1530a and 1530b are not subsequently readjusted. In other words, pins 1530a and 1530b are only adjusted once, in the manner described immediately hereinabove. Suitably adjusting the height of first segment 1510a with respect to the height of second segment 1510b, in turn, adjusts previously mentioned support platform 120 to the height of the knee of user 108, so that the knee of user 108 can be comfortably supported by support platform 120. Knee support platform 120 is configured to be mounted on or coupled to first segment 1510a for providing knee support or optionally for providing a seat for user 108. In other words, and as described in more detail hereinbelow, first segment 1510a is configured to receive support platform 120. Support platform 120 is shown in phantom in FIG. 15 for clarity in illustrating the invention.

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Still referring to FIGS. 15 and 16, first segment 1510a includes a handle 1540 sized to be gripped by a hand of user 108, so that user 108 can utilize segmented adaptable mobility aid device 1500 to move himself from one stair step (i.e., tread) to another stair step on the previously mentioned stairway 202 (see FIG. 2A). Also, if desired, user 108 can utilize segmented adaptable mobility aid device 1500 to move himself from one location to another location on the previously mentioned inclined walkway 102 (see FIG. 2A).

Referring yet again to FIGS. 15 and 16, handle 1540 of first segment 1510a includes a pair of elongate, parallel handle arms 1550a and 1550b integrally attached to a generally horizontally-oriented handlebar portion 1555. Handlebar portion 1555 has an inverted U-shape configuration, so that a hand of user 108 can easily grasp handle 1540. Handle arms 1550a and 1550b have a first chamber 1560a and a second chamber 1560b extending longitudinally therein, respectively, for reasons provided hereinbelow. First segment 1510a also includes a first pair of elongate, parallel legs 1570a and 1570b disposed generally opposite handle arms 1550a/1550b for reasons provided hereinbelow. A laterally extending first brace 1580a and a laterally extending second brace 1580b are coupled to respective ones of handle arms 1550a and 1550b and respective ones of legs 1570a and 1570b for providing structural rigidity to first segment 1510a, such that handle 1540 and legs 1570a/1570b are maintained in an upright position as segmented adaptable mobility aid device 1500 is utilized by user 108. More specifically, first brace 1580a has a first end 1584a thereof coupled to handle arm 1550a and a second end 1587a thereof coupled to leg 1570a. Similarly, second brace 1580b has a first end 1584b thereof coupled to handle arm 1550b and a second end 1587b thereof coupled to leg 1570b.

As shown in FIGS. 15 and 16, height of segmented adaptable mobility aid device 1500 is adjusted and locked to accommodate the height of user 108. More specifically, second segment 1510b includes a second pair of elongate, parallel legs 1590a and 1590b. As described in more detail momentarily, second pair of legs 1590a and 1590b is configured to slidably receive respective ones of first pair of legs 1570a/1570b. In this regard, second pair of legs 1590a/1590b has a third chamber 1600a and a fourth chamber 1600b longitudinally extending therein, respectively. Also, first pair of legs 1570a/1570b is sized to slidably fit within respective ones of third chamber 1600a and fourth chamber 1600b that are defined by second pair of legs 1590a/1590b. In addition, second pair of legs 1590a and 1590b have lower end portions 1605a and 1605b, respectively, for reasons provided hereinbelow. Previously mentioned apertures 1520 are formed through both second pair of legs 1590a/1590b of second segment 1510b and first pair of legs 1570a/1570b of first segment 1510a, so that, as apertures 1520 are aligned by vertical movement of first segment 1510a relative to second segment 1510b, pins 1530b and 1539c can be manually inserted into apertures 1520. Insertion of pins 1530b and 1530c into their respective apertures 1520 fixes the positions of first segment 1510a and second segment 1510b relative to each other. Moreover, as described in detail hereinbelow, previously mentioned cable and spring arrangement 1535 is utilized by user 108 to insert pins 1530a into apertures 1520 that are formed in support uprights 1610a/1610b (e.g., see FIG. 16).

With reference again to FIGS. 15 and 16, second segment 1510b also comprises a pair of elongate, parallel support uprights 1610a and 1610b that are coupled to respective ones of second pair of legs 1590a and 1590b. In this regard, support uprights 1610a/1610b are coupled to second pair of legs

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1590a/1590b by means of a laterally extending third support brace 1620a and a laterally extending fourth support brace 1620b. More specifically, third support brace 1620a and fourth support brace 1620b are coupled to respective ones of support uprights 1610a and 1610b and also coupled to respective ones of second pair of legs 1590a and 1590b for providing structural rigidity to second segment 1510b, such that support uprights 1610a/1610b and legs 1590a/1590b are maintained in an upright position as segmented adaptable mobility aid device 1500 is utilized by user 108. More particularly, third support brace 1620a has a first end 1624a thereof coupled to support upright 1610a and a second end 1624b thereof coupled to leg 1590a. Similarly, fourth support brace 1620b has a first end 1627a (see FIG. 16) thereof coupled to support upright 1610b and a second end 1627b thereof coupled to leg 1590b.

Referring again to FIGS. 15 and 16, support upright 1610a is sized to be slidably received in first chamber 1560a defined by handle arm 1550a and support upright 1610b is sized to be slidably received in second chamber 1560b defined by handle arm 1550b. In addition, support upright 1610a defines a third chamber 1630a therein and support upright 1610b defines a fourth chamber 1630b (see FIG. 16) therein for reasons provided hereinbelow.

As shown in FIGS. 15 and 16, third segment 1510c comprises a third pair of elongate, parallel legs 1640a and 1640b. Third pair of legs 1640a and 1640b have lower end portions 1645a and 1645b, respectively, for reasons provided hereinbelow. Leg 1640a is sized to be slidably received in third chamber 1630a that is defined by support upright 1610a. Leg 1640b is sized to be slidably received in fourth chamber 1630b that is defined by support upright 1610b. In this manner, the sliding engagement of third pair of legs 1640a/1640b of third segment 1510c with respective ones of third chamber 1630a and fourth chamber 1630b defined by support uprights 1610a/1610b of second segment 1510b allow the elevation of third segment 1510c to be slidably and downwardly adjusted relative to second segment 1510b, in the manner described in detail hereinbelow.

As shown in FIGS. 15 and 16, a first footer 1650, which may be a horizontally-extending elongate bar, is coupled to previously mentioned lower end portions 1605a/1605b that belong to respective ones of the pair of second legs 1590a/1590b provided by second segment 1510b. Similarly, a second footer 1670, which may be a horizontally-extending elongate bar, is coupled to previously mentioned lower end portions 1645a/1645b that belong to respective ones of the pair of third legs 1640a/1640b provided by third segment 1510c. First footer 1650 and second footer 1670 provide frictional contact of segmented adaptable mobility aid device 1500 with inclined surface 102 or the steps of stairway 202.

With reference to FIGS. 15 and 16, assembly of segmented adaptable mobility aid device 1500 will now be described. In this regard, support uprights 1610a/1610b are inserted in the direction of directional arrows 1675a/1675b into respective ones of chambers 1560a/1560b as first pair of legs 1570a/1570b are simultaneously inserted in the direction of directional arrows 1680a/1680b into respective ones of chambers 1600a/1600b. Insertion of support uprights 1610a/1610b into respective ones of chambers 1560a/1560b allows first segment 1510a to be mounted onto second segment 1510b. Similarly, third pair of legs 1640a/1640b is inserted in the direction of directional arrows 1685a/1685b into respective ones of chambers 1630a/1630b. Insertion of third pair of legs 1640a/1640b into respective ones of chambers 1630a/1630b allows second segment 1510b to be mounted onto third segment 1510c. As previously indicated, pins 1530a/1530b/



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1530c are manipulated by user 108, so as to engage their respective apertures 1520 in order to interlock segments 1510a/1510b/1510c. Support platform 120 is mounted onto braces 1580a/1580b, such as in the direction of directional arrow 1690, to provide knee support or optionally to provide a seat for user 108.

Referring to FIGS. 15, 16 and 17, previously mentioned cable and spring arrangement 1535 for manipulating first pins 1530a will now be described in detail. In this regard, cable and spring arrangement 1535 comprises a left pin and spring arrangement, generally referred to as 1700a, and a right pin and spring arrangement, generally referred to as 1700b. A left cable 1710a is coupled to a leftmost first pin 1530a and a right cable 1710b is coupled to a rightmost first pin 1530a, as shown. Each of cables 1710a/1710b is joined to a main cable 1720 at a junction 1730. Main cable 1720 is, in turn, coupled to a lever mechanism 1740 having an operable lever 1750. Lever mechanism 1740 is coupled either to leg 1550a or leg 1550b, such as by a band or strap 1760 extending around leg 1550a or leg 1550b, as the case may be. User 108 utilizes lever mechanism 1740 to engage pins 1530a into their associated apertures 1520 and to disengage pins 1530a from the apertures 1520. In this regard, user 108 operates or moves lever 1750, such as downwardly moving lever 1750, to tension main cable 1720. As main cable 1720 is tensioned, left cable 1710a and right cable 1710b are simultaneously placed in tension because left cable 1710a and right cable 1710b are joined to main cable 1720 at junction 1730. A portion of main cable 1720 may be in the form of a service loop 1765, if desired, for temporarily allowing slack in main cable 1720 before tensioning of main cable 1720. As described in detail hereinbelow, the configuration and operation of left pin and spring arrangement 1700a and the configuration and operation of right pin and spring arrangement 1700b allow first pins 1530a to engage and disengage apertures 1520 for the reasons provided hereinabove.

Referring again to FIGS. 15, 16 and 17, the configuration and operation of left pin and spring arrangement 1700a is described in detail presently. In this regard, left pin and spring arrangement 1700a that belongs to cable and spring arrangement 1535 includes an attachment bracket 1770, which spans support uprights 1610a/1610b. Attachment bracket 1770 includes a first vertical member 1780 and a second vertical member 1790 for left cable and spring arrangement 1700a. Pin 1530a passes through first vertical member 1780 and second vertical member 1790. Pin 1530a is integrally connected to left cable 1710a at an end portion of pin 1530a. A biasing member, such as a first spring 1800, encircles pin 1530a, and is positioned between first vertical member 1780 and a first washer 1810 that is affixed to pin 1530a. When lever mechanism 1740 is activated by user 108 moving lever 1750, left cable 1710a is drawn away from support upright 1610a a sufficient distance, pin 1530a is drawn out of aperture 1520, and first washer 1810 compresses first spring 1800 against first vertical member 1780. When lever mechanism 1740 is no longer activated, that is, when user 108 releases lever 1750, the energy stored in compressed first spring 1800 is released, with pin 1530a moving back into aperture 1520. When pin 1530a moves back into aperture 1520, pin 1530a secures leg 1640a against sliding movement within chamber 1630a of support upright 1610a.

Referring to FIGS. 15, 16, 17 and 18, the configuration and operation of right pin and spring arrangement 1700b is described in detail presently. In this regard, right pin and spring arrangement 1700b that belongs to cable and spring arrangement 1535 includes the attachment bracket 1770,

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which spans support uprights 1610a/1610b. Attachment bracket 1770 includes a third vertical member 1820 and a fourth vertical member 1830 for right cable and spring arrangement 1700b. Pin 1530a passes through third vertical member 1820 and fourth vertical member 1830. Pin 1530a is integrally connected to right cable 1710b at an end portion of pin 1530a. A biasing member, such as a second spring 1840, encircles pin 1530a, and is positioned between third vertical member 1820 and a second washer 1850 that is affixed to pin 1530a. When lever mechanism 1740 is activated by user 108 moving lever 1750, right cable 1710b is drawn away from support upright 1610b. As right cable 1710b is drawn away from support upright 1610b a sufficient distance, pin 1530a is drawn out of aperture 1520, and second washer 1850 compresses second spring 1840 against third vertical member 1820. When lever mechanism 1740 is no longer activated, that is, when user 108 releases lever 1750, the energy stored in compressed second spring 1840 is released, with pin 1530a moving back into aperture 1520. When pin 1530a moves back into aperture 1520, pin 1530a secures leg 1640b against sliding movement within chamber 1630b of support upright 1610b.

With reference to FIGS. 15, 16, 17 and 18, segmented adaptable mobility aid device 1500 is particularly useful for ascending and descending the steps of stairway 202. In this regard, when user 108 wants to ascend stairway 202, he positions segmented adaptable mobility aid device 1500 in front of the first step of stairway 202. At this point, first pins 1530a, second pin 1530b and third pins 1530c have been previously engaged with their respective apertures 1520, so that segments 1510a/1510b/1510c cannot move relative to each other. Also, at this point, first footer 1650 and second footer 1670 are at the same elevation with respect to each other, with first footer 1650 being positioned above surface 102 and with second footer 1670 being positioned above the first step of stairway 202. User 108 then operates the lever 1750 to release first pins 1530a from their respective apertures 1520 to allow first footer 1650 to drop to surface 102 by force of gravity. After first footer 1650 contacts surface 102, user 108 releases the lever 1750 to reengage pins 1530a with their associated apertures 1520.

It should be appreciated that the adjustment of segmented adaptable mobility aid device 1500 described hereinabove need be made only once when the steps of stairway 202 are the same height. However, segmented adaptable mobility aid device 1500 will require readjustment in the manner described hereinabove when the steps of stairway 202 have different heights.

Thus, it is appreciated from the teachings hereinabove that segmented adaptable mobility aid device 1500 is height-adjustable via use of second pins 1510b and third pins 1510c for accommodating users 108 of various heights. Also, segmented adaptable mobility aid device 1500 can be used to ascend and descend stairway 202 via activation of lever 1750, even when one leg of user 108 is immobile.

A segmented adaptable mobility aid device for use on a level walkway or on stairs has been described. The device has length-adjustable front and rear legs, a handle, and a knee support platform coupled to the legs and the handle, so that lengths of the legs can be adjusted in tandem via single-hand operability of an adjustment mechanism. The legs can be adjusted within a range of lengths suitable for walking on a level or inclined walkway, and for ascending and descending stairs. The segmented adaptable mobility aid device includes a knee support platform that, during stairway use, can straddle or span two steps, to better distribute the user's weight during ascent or descent of stairs. The device also includes an adjust-



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ment mechanism that can be activated with a single hand to enable length adjustability of the front legs for conversion between use on a level walkway and use on stairs. Embodiments of the invention provide the benefit of increased usability of the device and increased stability of a user during stairway use. Moreover, embodiments of the invention provide the further benefit of single hand operability of the adjustment mechanism.

Other modifications and implementations will occur to those skilled in the art without departing from the spirit and the scope of the invention as claimed. For example, a plurality of lockable wheels (not shown) may be removably coupled to respective ones of first footer **1650** and second footer **1670** for rolling segmented adaptable mobility aid device **1500** along level or inclined surface **102**. Accordingly, the above description is not intended to limit the invention except as indicated in the following claims.

What is claimed is:

1. A segmented adaptable mobility aid device that is easily adjusted by a user to accommodate variations in elevation of a surface on which it is deployed comprising:
  - a first of at least three segments comprising:
    - a handle extending upwardly in a substantially vertical orientation; and
    - a top portion of a pair of vertically oriented back legs; and
  - a second one of the at least three segments comprising:
    - a bottom portion of the back pair of legs configured to slideably engage with the top portion of the back pair of legs of the first segment, the bottom portion having a first footer coupled to the end of each of the pair of back legs; and
    - a middle portion of a front pair of legs being slideably engaged with the bottom of the handle;
  - a third one of the at least three segments comprising a bottom portion of the front pair of legs that is configured to be slideably engaged with the middle portion of the front pair of legs of the second segment, the bottom portion having a second footer commonly coupled to the end of each of the pair of front legs;
 means for establishing a relative position between the second and first footers using the force of gravity, the relative position stably accommodating the relative variations in elevation of the surface, the means for establishing comprising:
  - a first means for conjointly adjusting and fixing a relative position between the slideably engaged top and bottom portions of each of the back pair of legs;
  - a second means for conjointly adjusting and fixing a relative position between the slideably engaged handle and the middle portion of each of the front pair of legs; and
  - a third means for conjointly adjusting and fixing a relative position between the slideably engaged middle and bottom portions of the front pair of legs to establish the accommodating relative position, the third means including a lever coupled proximately to the handle, the lever, when actuated, permitting the bottom portions of the front pair of legs to extend or retract as necessary to establish the accommodating relative position using gravity, the relative position being determined when the force of gravity has caused both the front and back feet to be in contact with the surface.
2. The segmented adaptable mobility aid device of claim 1, wherein the means for establishing permits the handle to be

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raised and lowered without affecting the relative position between the first footer and the second footer.

3. The segmented adaptable mobility aid device of claim 2, wherein:

the first, second and third means for conjointly adjusting and fixing includes a set of pins and a plurality of apertures, each of the at least three segments being slideably adjustable when the segment's set of pins are withdrawn from the apertures and refrained from sliding when the segment's set of pins is engaged in any of the apertures, and

the lever of the third means is coupled to the set of pins off the third segment by a cable.

4. The aid apparatus of claim 1 wherein:

the first segment further comprises a platform disposed in a plane substantially perpendicular to the handle, and the front and back pairs of legs; and

the platform is configured to be height adjusted, by raising and lowering the first segment relative to the second and third segments, to facilitate support of the user at the knee in lieu of the user's foot.

5. A segmented adaptable mobility aid device comprising: a first of at least three segments comprising:

a handle extending upwardly in a substantially vertical orientation; and

a top portion of a pair of vertically oriented back legs;

a second one of the at least three segments comprising:

a bottom portion of the back pair of legs configured to slideably engage with the top portion of the back pair of legs of the first segment, the bottom portion having a first footer coupled to the end of each of the back pair of legs; and

a middle portion of a front pair of legs being slideably engaged with the bottom of the handle;

a third one of the at least three segments is slideably engaged with the second segment comprising a bottom portion of the front pair of legs that is configured to be slideably engaged with the middle portion of the front pair of legs of the second segment, the bottom portion having a second footer commonly coupled to the end of each of the front pair of legs;

a first pin and aperture adjustment mechanism for conjointly adjusting and fixing a relative position between the slideably engaged top and bottom portions of each of the back pair of legs;

a second pin and aperture adjustment mechanism for conjointly adjusting and fixing a relative position between the slideably engaged handle and the middle portion of each of the front pair of legs; and

a third pin and aperture adjustment mechanism for conjointly adjusting and fixing a relative position between the slideably engaged middle and bottom portions of the front pair of legs to establish a relative position between the second and first footers that stably accommodates a surface,

wherein the first and second pin and aperture adjustment mechanisms adjust the height of the handle to accommodate a user independent of the accommodating relative position between the second and first footers, and

wherein the third pin and aperture adjustment mechanism is configured to allow the user to permit the bottom portions of the front pair of legs to extend or retract as necessary to establish the accommodating relative position using gravity, the third pin and aperture adjustment mechanism further being configured to fix the bottom portions of the front pair of legs once the accommodating relative position is established.

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6. The segmented adaptable mobility aid device of claim 5, wherein

the third pin and aperture adjustment mechanism includes a cable coupled between a set of pins and a lever mechanism, the each of the set of pins configured to be retractably received by a set of apertures disposed in each of the pair of front legs, and

the lever mechanism is configured to retract each of the set of pins from the apertures when actuated to permit the bottom portion of the front pair of legs to slide until both the second and first footers are stably resting on the surface to establish the accommodating position, the lever mechanism being further configured to fix the front pair of legs at the accommodating relative position when the lever mechanism is released by allowing each of the set of pins to engage with apertures accessible at the accommodating relative position.

7. The aid apparatus of claim 5 wherein:

the first segment further comprises a platform disposed in a plane substantially perpendicular to the handle, and the front and back pairs of legs; and

the platform is configured to be height adjusted, by raising and lowering the first segment relative to the second and third segments, to facilitate support of the user at the knee in lieu of the user's foot.

8. A segmented mobility aid apparatus operable to accommodate level and non-level surfaces comprising:

a first segment forming:

a handle; and

a top portion of a back pair of legs;

a second segment forming:

a bottom portion of the back pair of legs configured to slideably cooperate with the top portion, the bottom portion of the pair terminating with a first footer for contacting a surface upon which said apparatus is to be deployed; and

a middle portion of a front pair of legs configured to slideably cooperate with the handle;

a third segment forming a bottom portion of the front pair of legs, the bottom portion of the pair co-terminating to form a second footer for contacting the surface upon which said aid device is to be deployed, the bottom portion configured to be slideably engaged with the middle portion of the front legs;

first and second pin and aperture adjustment mechanisms for conjointly adjusting and fixing the first segment with respect to the second segment; and

a third pin and aperture adjustment mechanism for conjointly adjusting and fixing the third segment with respect to the second segment,

whereby:

raising and lowering the first segment with respect to the second segment raises and lowers the handle without affecting a relative position between the first footer and second-footer; and

raising and lowering the third segment with respect to the second segment retracts or extends respectively, the front pair of legs using gravity to establish a relative position between the second and first footers to stably accommodate for unevenness in the surface.

9. The aid apparatus of claim 8 wherein:

the first segment further comprises a platform disposed in a plane substantially perpendicular to the handle, and the front and back pairs of legs; and

the platform is configured to be height adjusted, by raising and lowering the first segment relative to the second and

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third segments, to facilitate support of the user at the knee in lieu of the user's foot.

10. The aid apparatus of claim 9 wherein the platform is configured to be height adjusted, by raising and lowering the first segment relative to the second and third segments, to support the user in a sitting position.

11. The aid apparatus of claim 9 wherein the top portion of the back pair of legs formed by the first segment includes a first pair of tubular members that are configured to be slideably received by the bottom portions of each of the back pair of legs formed by the second segment, the platform being supported by the first segment at, and substantially perpendicular to, the top of the pair of tubular members of the top portion.

12. The aid apparatus of claim 11 wherein the middle portion of the front legs formed by the second segment comprises a pair of tubular members, and

the handle of the first segment is formed of a pair of tubular members that are configured to slideably receive the tubular members off the middle portion of the front legs formed by the second segment.

13. The aid apparatus of claim 12 wherein:

the first pin and aperture adjustment mechanism includes a plurality of apertures in at least one of the pair of tubular members of the top portion formed by the first segment, alignable with a plurality of apertures in the tubular members of the bottom portion of at least one of the back pair of legs; and

at least one pin that can be actuated to engage and disengage from at least one pair of the aligned apertures to fix the relative position between the pair of tubular members of the top portion and the pair of tubular members of the bottom portion of at least one of the back pair of legs when engaged.

14. The aid apparatus of claim 12 wherein:

the second pin and aperture adjustment mechanism comprises:

a plurality of apertures in at least one of the pair of tubular members formed by the handle, alignable with a plurality of apertures in the middle portion of at least one of the front pair of legs; and

at least one pin that can be actuated to engage and disengage from at least one pair of the aligned apertures.

15. The aid apparatus of claim 12 wherein:

the third pin and aperture adjustment mechanism comprises:

a plurality of apertures in at least one of the pair of tubular members of the bottom portion of the front legs, alignable with a plurality of apertures in the tubular members of the middle portion of at least one of the front pair of legs; and

at least one pin that can be actuated to engage and disengage from at least one pair of the aligned apertures.

16. The aid apparatus of claim 8 wherein the handle is configured to be height adjusted, by raising and lowering the first segment relative to the second and third segments, to a position that facilitates lifting and placing of said aid apparatus on the surface by a user.

17. The aid apparatus of claim 8 wherein the lower portion of the front legs formed by the third segment comprises a pair of tubular members and are configured to be slideably received by the tubular members of the middle portion of the back legs formed by the second segment.